Benjamin Judkins

Boston.

Massachusetts

Corner of

Cambridge Street

and

Blossom Street

West End

THE

ARTIST'S COMPANION,

AND

MANUFACTURER'S GUIDE,

CONSISTING OF THE

MOST VALUABLE SECRETS

IN ARTS AND TRADES.

Calico Printing....Bleaching of Cotton and Paper....Dyeing of Wood, Bones, &c.

Engraving and Etching on Copper....Engraving in Aquatinta....Engraving on Wood.

Dyeing of various Colours....Manufacture of Glass, Pottery, Beer, &c.

WITH ABOVE FIVE HUNDRED VALUABLE MODERN RECEIPTS; FORMING A GREAT VARIETY OF USEFUL ARTICLES, COLLECTED FROM THE LATEST EUROPEAN PUBLICATIONS.

By a Friend to American Manufactures.

BOSTON:
Published by J. Norman, Chart-seller, No. 1, North-Row,
E. G. House, Printer.
.....
1814.

DISTRICT OF MASSACHUSETTS, to wit:

BE it remembered, that on the twentieth day of August, A. D. 1814, and in the thirty-ninth year of the independence of the United States of America, John Norman of the said District, has deposited in this office, the title of a book the right whereof he claims as proprietor, in the words following, to wit: "The Artist's Companion and Manufacturer's Guide, consisting of the most valuable secrets in arts and trades. Calico printing—bleaching of cotton and paper—dyeing of wood, bones, &c.—engraving and etching on copper—engraving in aquatinta; engraving on wood. Dyeing of various colours; manufacture of glass, pottery, beer, &c. With above five hundred valuable modern receipts, forming a great variety of useful articles, collected from the latest European publications. By a Friend to American Manufactures

In Conformity to the Act of Congress of the United States, intitled "An Act for the Encouragement of Learning, by securing the Copies of Maps, Charts and Books, to the Authors and Proprietors of such Copies, during the times therein mentioned;" and also to an Act, intitled, "An Act supplementary to an Act, intitled, An Act for the Encouragement of Learning by securing the Copies of Maps, Charts, and Books to the Authors and Proprietors of such Copies, during the times therein mentioned; and extending the Benefits thereof to the Arts of Designing, Engraving and Etching Historical, and other prints.

Wm. S. SHAW, Clerk of the District of Massachusetts.

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SECRETS

IN

ARTS *and* TRADES.

1. CALICO PRINTING.

CALICO printing is the art of communicating different colours to particular spots, or figures, on the surface of cotton or linen cloth, while the rest of the stuff retains its original whiteness.

This ingenious art seems to have originated in India, where we know it has been practised for more than 2000 years. It has but lately been cultivated in Europe, but the enlightened industry of our manufacturers has already improved prodigiously upon the tedious processes of their Indian masters. No art has arisen to perfection with greater celerity: a hundred years ago it was scarcely known in Europe; at present, the elegance of the patterns, the beauty and permanency of the colours, and the expedition with which the different operations are carried on, are really admirable.

Calico printing consists in impregnating those parts of the cloth which are to receive a colour, with a mordant, and then dyeing it as usual with some dye stuff or other. The dye stuff attaches itself firmly only to that part of the cloth which has received the mordant. The whole surface of the cotton is indeed more or less tinged, but by washing it, and bleaching it for some days on the grass, with the wrong side uppermost, all the unmordanted parts resume their original colour, while those which have received the mordant retain it. Let us suppose that a piece of white cotton cloth is to receive red stripes; all the parts where the stripes are to appear are pencilled over with a solution of acetite of alumine; after this, the cloth is dyed in the usual manner with madder. When taken out of the dyeing vessel it is all of a red colour, but by

washing and bleaching, the madder leaves every part of the cloth white, except the stripes impregnated with the acetite of alumine, which remain red. In the same manner may yellow stripes, or any other wished-for figure, be given to cloth, by substituting quercitron bark, weld, &c. for madder.

When different colours are to be given to different parts of the cloth at the same time, it is done by impregnating it with various mordants. Thus, if stripes be drawn upon a cotton cloth with acetite of alumine, and other stripes with acetite of iron, and the cloth be afterwards dyed in the usual way with madder, and then washed and bleached, it will be striped *red* and *brown*. The same mordants with quercitron bark, give *yellow* and *olive*, or *drab*.

The mordants employed in calico printing are acetite of alumine, and acetite of iron, prepared in the manner described. These mordants are applied to the cloth, either with a pencil, or by means of blocks, on which the pattern, according to which the cotton is to be printed, is cut. As they are applied only to particular parts of the cloth, care must be taken that none of them spread to the part of the cloth which is to be left white, and that they do not interfere with one another when more than one are applied. If these precautions be not attended to, all the elegance and beauty of the print must be destroyed. It is necessary, therefore, that the mordants should be of such a degree of consistence, that they will not spread beyond those parts of the cloth on which they are applied. This is done by thickening them with flour or starch, when they are to be applied by the block; and with gum-arabic, when they are to be put on by a pencil. The thickening should never be greater than is sufficient to prevent the spreading of the mordants; when carried too far, the cotton is apt not to be sufficiently saturated with the mordants; of course the dye takes but imperfectly.

In order that the parts of the cloth impregnated with mordants may be distinguished by their colour, it is usual to tinge the mordants with some colouring matter or other. The printers commonly use the decoction of Brazil-wood for this purpose; but Dr. BANCROFT has objected to this method, because he thinks that the Brazil-wood colouring matter impedes the subsequent process of dyeing. It is certain, that the colouring matter of the Brazil-wood is displaced during that operation, by the superior affinity of the dye stuff for the mordants. Were it not for this superior affinity, the colour would not take at all. Dr. BANCROFT advises to colour the mordant with some of the dye stuff afterwards to be applied; and he cautions the using of more for that purpose, than is sufficient to make the mordant distinguishable when applied to the cloth. The reason of this precaution is obvious. If too much dye be mixed with the mordant, a

great proportion of the mordant will be combined with colouring matter, which must weaken its affinity for the cloth, and of course prevent it from combining with it, in sufficient quantity to ensure a permanent dye.

Sometimes these two mordants are mixed together in different proportions; and sometimes one or both is mixed with an infusion of sumach, or of nut-galls. By these contrivances, a great variety of colours are produced by the same dye stuff.

After the mordants have been applied, the cloth must be completely dried. It is proper for this purpose to employ artificial heat, which will contribute something towards the separation of the acetous acid from its base, and towards its evaporation, by which the mordant will combine in a greater proportion, and more intimately with the cloth.

When the cloth is sufficiently dried, it is to be washed with warm water and cow-dung, till all the flour, or gum, employed to thicken the mordants, and all those parts of the mordants which are uncombined with the cloth, be removed. The cow-dung serves to entangle these loose parts of the mordants, and to prevent them from combining with those parts of the cloth which are to remain white. After this, the cloth is thoroughly rinsed in clean water. Almost the only dye stuffs employed by calico printers, are indigo, madder, and quercitron bark, or weld. This last substance, however, is but little used by the printers of this country, except for delicate greenish yellows. The quercitron bark has almost superseded it, because it gives colours equally good, and is much cheaper and more convenient, not requiring so great a heat to fix it. Indigo not requiring any mordant, is commonly applied at once, either with a block or a pencil. It is prepared by boiling together indigo, potash made caustic by quick-lime, and orpiment; the solution is afterwards thickened with gum. It must be carefully secluded from the air, otherwise the indigo would soon be regenerated, which would render the solution useless. Dr. BANCROFT has proposed to substitute coarse brown sugar for orpiments: it is equally efficacious in decomposing the indigo, and rendering it soluble; while it likewise serves all the purposes of gum.

When the cloth, after being impregnated with the mordant, is sufficiently cleansed, it is dyed in the usual manner. The whole of it is more or less tinged with the dye stuff. It is well washed, and then spread out for some days on the grass, and bleached with the wrong side uppermost. This carries the colour off completely from all the parts of the cotton which have not imbibed the mordant, and leaves them of their original whiteness, while the mordanted spots retain the dye as strongly as ever.

Let us now give an example or two of the manner in which the printers give particular colours to calicoes. Some cali-

coes are only printed of one colour, others have two, others three or more, even to the number of eight, ten, or twelve. The smaller the number of colours, the fewer in general are the processes.

1. One of the most common colours on cotton prints is a kind of nankeen yellow, of various shades down to a deep yellowish brown, or drab. It is usually in stripes or spots. To produce it, the printers besmear a block, cut out into the figure of the print, with acetite of iron, thickened with gum or flour; and then apply it to the cotton, which, after being dried and cleansed in the usual manner, is plunged into a potash ley. The quantity of acetite of iron is always proportioned to the depth of the shade.

2. For yellow, the block is besmeared with acetite of alumine. The cloth, after receiving this mordant, is dyed with quercitron bark, and then bleached.

3. Red is communicated by the same process; only madder is substituted for the bark.

4. The fine light blues which appear so often on printed cottons, are produced by applying to the cloth, a block besmeared with a composition, consisting partly of wax, which covers all those parts of the cloth which are to remain white. The cloth is then dyed in a cold indigo vat; and after it is dry, the wax composition is removed by hot water.

5. Lilac flea brown, and blackish brown, are given by means of acetite of iron; the quantity of which is always proportioned to the depth of the shade. For very deep colours, a little sumach is added. The cotton is afterward dyed in the usual manner with madder, and then bleached.

6. Dove colour and drab, by acetite of iron and quercitron bark.

When different colours are to appear in the same print, a greater number of operations are necessary. Two or more blocks are employed, upon each of which, that part of the print only is cut, which is to be of some particular colour. These are besmeared with different mordants, and applied to the cloth, which is afterwards dyed as usual. Let us suppose, for instance, that these blocks are applied to cotton, one with acetite of alumine, another with acetite of iron, a third with a mixture of those two mordants, and that the cotton is then dyed with quercitron bark, and bleached. The parts impregnated with the mordants would have the following colours.

Acetite of alumine,	Yellow.
——— iron,	Olive, drab, dove.
The mixture,	Olive green, olive.

If part of the yellow be covered over with the indigo liquor, applied with a pencil, it will be converted into *green*. By the same liquid, blue may be given to such parts of the print as require it.

If the cotton be dyed with madder, instead of quercitron bark, the print will exhibit the following colours.

Acetite of alumine,	Red,
——— iron,	Brown, black.
The mixture,	Purple.

When a greater number of colours are to appear; for instance, when those communicated by bark, and those by madder, are wanted at the same time, mordants for part of the pattern are to be applied; the cotton is then to be dyed in the madder bath, and bleached; then the rest of the mordants, to fill up the pattern, are added, and the cloth is again dyed with quercitron bark, and bleached. The second dyeing does not much affect the madder colours; because the mordants, which render them permanent, are already saturated. The yellow tinge is easily removed by the subsequent bleaching. Sometimes a new mordant is also applied to some of the madder colours, in consequence of which, they receive a new permanent colour from the bark. After the last bleaching, new colours may be added by means of the indigo liquor. The following table will give an idea of the colours, which may be given to cotton by these complicated processes.

I. *Madder Dye.*

	Colours.
Acetite of alumine,	Red,
——— iron,	Brown, black.
——— diluted,	Lilac.
Both, mixed,	Purple.

II. *Bark Dye.*

Acetite of alumine,	Yellow.
——— iron,	Dove, drab.
Lilac and acetite of alumine,	Olive.
Red and acetite of alumine,	Orange.

III. *Indigo Dye.*

Indigo,	Blue.
Indigo and yellow,	Green.

Thus no less than 12 colours may be made to appear together in the same print, by these different processes.

These instances will serve to give the reader an idea of the nature of calico printing, and at the same time afford an excellent illustration of the importance of mordants in dyeing.

If it were possible to procure colours sufficiently permanent, by applying them at once to the cloth by the block or pencil, as is the case with the mordants, the art of calico

printing would be brought to the greatest possible simplicity; but at present, this can only be done in one case, that of indigo; every other colour requires dyeing. Compositions, indeed, may be made, by previously combining the dye stuff and the mordants. Thus *yellow* may be applied at once, by employing a mixture of the infusion of quercitron bark and acetite of alumine; *red*, by mixing the same mordant with the decoction of alumine, and so on. The colours applied in this way, are, unfortunately, far inferior in permanency to those produced when the mordant is previously combined with the cloth, and the dye stuff afterwards applied separately. In this way are applied almost all the fugitive colours of calicoes, which washing, or even exposure to the air, destroys.

As the application of colours in this way cannot always be avoided by calico printers, every method of rendering them more permanent is an object of importance.

2. BLEACHING OF COTTON.

Cotton is a filamentous substance, or a kind of down which envelopes the seeds of the cotton plant. This plant or shrub comes from the east, and grows only in warm climates.

This substance, after being separated from the seeds, is always charged with a coarse colouring matter, which soils it, and renders it opaque. The presence of this unctuous matter is proved by the slowness with which cotton absorbs water before it is scoured, and by the force with which it absorbs it after the operation; by which means, from being opaque, it is rendered clear and transparent.

Cotton varies a great deal in its qualities, according to the different kinds, the climate where produced, and the culture employed. Its colour is sometimes yellow, and sometimes white, but, in general, it is of a dirty yellow.

To bleach it, does not require the same preparations as hemp and flax. The first operation consists in scouring it in a slight alkaline solution, or, what is better, by exposure to steam. It is afterwards put into a basket, and rinsed in running water. The immersing of cotton in an alkaline ley, however it be rinsed, always leaves with it an earthy deposit. It is well known that cotton bears the actions of acids better than hemp or flax; that time is even necessary before the action of them can be prejudical to it, and by taking advantage of this valuable property in regard to bleaching, means have been found to free it from the earthy deposit, by pressing down the cotton in a very weak solution of sulphuric acid, and afterwards removing the acid by washing, lest too long remaining in it should destroy the cotton.

3. BLEACHING OF PAPER.

The oxygenated muriatic acid has also been applied to the bleaching of paper, which it has rendered considerably more expeditious.

Bleaching of old printed papers, to be worked up again. Boil the paper for an instant in a solution of soda, rendered caustic by potash. Steep it in soap-water, and then wash it, after which the paper may be reduced to a pulp by the paper-mill.

Bleaching of old written papers to be worked again. Steep the papers in a cold solution of sulphuric acid in water, after which wash them before they are taken to the mill. If the acidulated water be heated, it will be the more effectual.

Bleaching of printed papers without destroying the texture of the leaves. Steep the leaves in a caustic solution of soda, and afterwards in one of soap. Arrange the sheets alternately between cloths, in the same manner as paper-makers dispose their sheets of paper when delivered from the form. Put the leaves in a press, and they will become whiter, unless they were originally loaded with printer's ink or size. If this should not completely effect the whitening of the leaves, repeat the process a second, or even a third time.

Bleaching coloured rags to make white paper. Soak or macerate the rags sufficiently—put them into a solution of caustic alkali, and then into the oxygenated muriatic acid, and lastly steep them in diluted sulphuric acid.

4. OF ENGRAVING.

Engraving, or *graving* as it is generally called, is cutting lines upon a copper-plate, by means of a steel instrument, called a graver, without the use of aqua fortis.

This was the first way of producing copper-plate prints that was practised, and is still much used in historical subjects, portraits, and in finishing landscapes.

The tools necessary for this art are, gravers, a scraper, a burnisher, an oil stone, a sand bag, an oil rubber, and some good charcoal.

The gravers are instruments of tempered steel, fitted into a short wooden handle. They are of two sorts, square and lozenge; the first is used in cutting very broad strokes, the other for fainter and more delicate lines.

The scraper is a three-edged tool, for scraping off the burr raised by the graver. Burnishers are for rubbing down any lines that are too deep, or burnishing out any scratches or holes in the copper: they are of very hard steel, well rounded and polished.

The oil stone is for whetting the gravers, etching points, &c.

The sand-bag, or cushion, is for laying the plate upon, for the conveniency of turning it round in any direction.

The oil-rubber and charcoal are for polishing the plate when necessary.

As great care is required to whet the graver nicely, particularly the belly of it, care must be taken to lay the two angles of the graver which are to be held next the plate flat upon the stone, and rub them steadily, till the belly rises graduaily above the plate, so as that, when you lay the graver flat upon it, you may just perceive the light under the point; otherwise it will dig into the copper, and then it will be impossible to keep a point, or execute the work with freedom. In order to this, keep your right arm close to your side, and place the fore finger of your left hand upon that part of the graver which lies upermost on the stone. When this is done, in order to whet the face, place the flat part of the handle in the hollow of your hand, with the belly of the graver upwards, upon a moderate slope, and rub the extremity, or face, upon the stone, till it has an exceedingly sharp point, which you may try upon your thumb-nail.

When the graver is too hard, as is usually the case when first bought, and may be known by the frequent breaking of the point, the method of tempering it is as follows: Heat a poker red-hot, and hold the graver upon it, within half an inch of the point, till the steel changes to a light straw colour; then put the point into oil, to cool; or, hold the graver close to the flame of a candle, till it be of the same colour, and cool it in the tallow; but be careful either way, not to hold it too long, for then it will be too soft; and in this case, the point, which will then turn blue, must be tempered again. Be not too hasty in tempering; for sometimes a little whetting will bring it to a good condition, when it is but a little too hard.

To hold the graver, cut off that part of the handle which is upon the same line with the belly, or sharp edge of the graver, making that side flat, that it may be no obstruction.

Hold the handle in the hollow of your hand; and, extending your fore finger towards the point, let it rest on the back of the graver, that you may guide it flat and parallel with the plate. Take care that your fingers do not interpose between the plate and the graver; for they will hinder you from carrying the graver level with the plate, and from cutting your strokes so clean as they ought to be.

To lay the design upon the plate, after you have polished it, fine and smooth, heat it so that it will melt virgin-wax, with which rub it thinly and equally over, and let it cool. Then the design which you lay on, must be drawn on paper, with a black-lead pencil, and laid upon the plate, with its penciled side upon the wax, then press it to, and with a bur-

nisher go over every part of the design, and when you take off the paper, you will find every line which you drew with the black-lead pencil upon the waxed plate, as if it had been drawn; then with a sharp pointed tool trace all your design through the wax upon the plate, and you may then take off the wax, and proceed to work.

Let the table, or board you work at, be firm and steady, upon which place your sand bag with the plate upon it; and, holding the graver as above directed, proceed in the following manner:

For straight strokes, hold your plate firm upon the sand-bag with your left hand, moving your right hand forwards; leaning lighter where the strokes should be fine, and harder where you would have it broader.

For circular or crooked strokes, hold the graver stedfast, moving your hand or the plate, as you see convenient.

Learn to carry your hand with such dexterity, that you may end your stroke as finely as you began it; and if you have occasion to make one part deeper or blacker than another, do it by degrees; and that you may do it with greater exactness, take care that your strokes be not too close, nor too wide.

In the course of your work scrape off the roughness which arises, with your scraper; but be careful, in doing this, not to scratch the plate; and that you may see your work properly as you go on, rub it with the oil-rubber, and wipe the plate clean, which will take off the glare of the copper, and shew what you have done to the best advantage.

Any mistakes or scratches in the plate may be rubbed out with the burnisher, and the part levelled with the scraper, polishing it again afterwards lightly with the burnisher, or charcoal.

Having thus attained the use of the graver, according to the foregoing rules, you will be able to finish the piece you had etched, by graving up the several parts to the colour required; beginning, as in the etching, with the fainter parts, and advancing gradually with the stronger, till the whole is completed.

The dry point or needle (so called because not used till the ground is taken off the plate) is principally employed in the extremely light parts of water, sky, drapery, architecture, &c.

To prevent any obstruction from too great a degree of light, the use of a sash, made of transparent, or fan paper, pasted on a frame, and placed sloping at a convenient distance between your work and the light, will preserve the sight; and when the sun shines, it cannot possibly be dispensed with.

5. *The Method of Etching Copper Plates.*

Etching is a manner of engraving on copper, in which the lines or strokes, instead of being cut with a tool or graver, are corroded in with aqua fortis.

It is a much later invention than the art of engraving by cutting the lines on the copper, and has many advantages over it for some purposes, though it cannot supersede the use of the graver entirely, as there are many things that cannot be etched so well as they can be graved.

In almost all the engravings on copper that are executed in the stroke manner, etching and graving are combined, the plate being generally begun by etching, and finished with the graver. Landscapes, architecture, and machinery, are the subjects that receive most assistance from the art of etching; for it is not so applicable to portraits and historical designs, though in these also a great deal is done by etching.

We shall first describe the various instruments and materials used in the art.

Copper-Plates may be had ready prepared at the coppersmiths, by those who reside in large towns; but when this cannot be had, procure a piece of pretty thick sheet-copper from a brazier, rather larger than your drawing, and let him planish it well; then take a piece of pumicestone, and with water rub it all one way, till the surface is as smooth and level as it can be made by that means: a piece of charcoal is next used with water, for polishing it still further, and removing the deep scratches made by the pumicestone; and it is then finished with a piece of charcoal of a finer grain, with a little oil.

Etching-points or *needles* are pointed instruments of steel, about an inch long, fixed in handles of hard wood, about six inches in length, and of the size of a goose-quill. They should be well tempered, and very accurately fixed in the centre of the handle. They must be brought to an accurately conical point, by rubbing upon an *oil-stone*, with which the engraver must be provided. Several of these points will be necessary.

A *paralell-ruler* is used for drawing parallel straight lines with. This is best when faced with brass, as it is not then so liable to be bruised by accident.

Compasses are useful for striking circles and measuring distances.

Aqua fortis, or what is better, spirits of nitre (nitrous acid), is used for corroding the copper, or *biting*-in, as it is called. This must be kept in a bottle with a glass stopple, for its fumes destroy corks. A stopple made of wax will serve as a substitute, or a cork well covered with wax. *Bordering-wax*, for

surrounding the margin of the copper-plate when the aqua fortis is pouring on. This may be bought ready prepared, but it may be made as follows.

Take one-third of bees-wax to two-thirds of pitch; melt them in an iron ladle, and pour them, when melted, into water lukewarm; then mould it with your hand till it is thoroughly incorporated, and all the water squeezed out. Form it into rolls of convenient size.

Turpentine-varnish is used for covering the copper-plate with, in any part where you do not wish the aqua fortis to bite. This may be diluted to a proper consistence with turpentine, and mixed with lamp-black, that it may be seen better when laid upon the plate.

Etching-ground is used for covering the plate all over with, previous to drawing the lines on it with the needles. It is prepared in the following manner. Take of virgin-wax and asphaltum, each twenty ounces, of black-pitch and Burgundy-pitch, each half an ounce; melt the wax and pitch in a new earthen-ware glazed pipkin, and add to them, by degrees, the asphaltum finely powdered. Let the whole boil till such time as that, by taking a drop upon a plate, it will break when it is cold, on bending it double two or three times between the fingers. The varnish being then enough boiled, must be taken off from the fire, and letting it cool a little, must be poured into warm water, that it may work the more easily with the hands, so as to form into balls for use.

It must be observed, first, that the fire be not too violent, for fear of burning the ingredients; a slight simmering will be sufficient; secondly, that while the asphaltum is putting in, and even after it is mixed with them, the ingredients should be stirred continually with a spatula; and thirdly that the water into which this composition is thrown, should be nearly of the same degree of warmth with it, to prevent a kind of cracking, which happens when the water is too cold.

The varnish ought always to be harder in summer than winter, and it will become so if it be suffered to boil longer, or if a greater proportion of the asphaltum be used. The experiment above mentioned, of the drop suffered to cool, will determine the degree of hardness or softness that may be suitable to the season when it is used.

To lay the ground for etching, proceed in the following manner. Having cleaned the copper-plate with some fine whiting and a linen rag, to free it from all grease, fix a hand-vice to some part of it where no work is intended to be, to serve as a handle for managing it by when warm. Roll up some coarse brown paper, and light one end; then hold the back of the plate over the burning paper, moving it about until every part of it is equally heated, so as to melt the etching-ground, which should be wrapped up in a bit of taffety,

to prevent any dirt, that may happen to be among it, from mixing with what is melted upon the plate. If the plate be large, it will be best to heat it over a chafing-dish with some clear coals. It must be heated just sufficient to melt the ground, but not so much as to burn it. When a sufficient quantity of the etching-ground has been rubbed upon the plate, it must be dabbed, or beat gently, while the plate is hot, with a small dabber made of cotton wrapped up in a piece of taffety, by which operation the ground is distributed more equally over the plate than it could be by any other means.

When the plate is thus uniformly and thinly covered with the varnish, it must be blackened by smoking it with a wax-taper. For this purpose twist together three or four pieces of wax-taper to make a larger flame, and while the plate is still warm, hold it with the varnished side downwards, and move the smoky part of the lighted taper over its surface, till it is made almost quite black taking care not to let the wick touch the varnish, and that the latter get no smear or stain. In laying the etching-ground, great care must be taken that no particles of dust or dirt of any kind settle upon it, as that would be found very troublesome in etching; the room therefore in which it is laid should be as still as possible, and free from dust.

The ground being now laid, and suffered to cool, the next operation is to transfer the design to the plate.

For this purpose a tracing on oiled paper must now be made from the design to be etched, with pen and ink, having a very small quantity of ox's gall mixed with it, to make the oiled paper take it; also a piece of thin paper, of the same size, must be rubbed over with red chalk, powdered, by means of some cotton. Then laying the red chalked paper, with its chalked side next the ground, on the plate, put the tracing over it, and fasten them both together, and to the plate, by a little bit of the bordering-wax.

When all this is prepared, take a blunt etching needle, and go gently all over the lines in the tracing; by which means the chalked paper will be pressed against the ground, and the lines of the tracing will be transferred to it: on taking off the papers, they will be seen distinctly.

The plate is now prepared for drawing through the lines which have been marked upon the ground. For this, the etching-points or needles are employed, leaning hard or lightly, according to the degree of strength required in the lines. Points of different sizes and forms are also used, for making lines of different thickness, though commonly this is effected by the biting-in with the aqua fortis.

A margin or border of wax must now be formed all round the plate, to hold the aqua fortis when it is poured in. To do

this, the bordering-wax already described must be put into lukewarm water to soften it, and render it easily worked by the hand. When sufficiently pliable, it must be drawn out into long rolls, and put round the edges of the plate, pressing it down firm, and forming it with the fingers into a neat wall or margin. A spout must be formed in one corner, to pour off the aqua fortis by afterwards.

The nitrous acid (spirits of nitre) is now to be diluted with four or five times as much water, or more (according as you wish the plate to be bit quick or slow), and poured upon the plate. In a few minutes you will see minute bubbles of air filling all the lines that have been drawn on the copper, which are to be removed by a feather; and the plate must be now and then *swept*, as it is called, or kept free from air bubbles. By the more or less rapid production of these bubbles, you judge of the rapidity with which the acid acts upon the copper. The biting-in of the plate is the most uncertain part of the process, and nothing but very great experience can enable any one to tell when the plate is bit enough, as you cannot easily see the thickness and depth of the line till the ground is taken off.

When you judge, from the time the acid has been on, and the rapidity of the biting, that those lines which you wish to be the faintest are as deep as you wish, you pour off the aqua fortis by the spout, wash the plate with water, and dry it, by blowing with bellows, or by the fire, taking care not to melt the ground.

Those lines that are not intended to be bit any deeper, must now be stopped up with turpentine-varnish mixed with a little lamp-black, and laid on with a camel's hair pencil; and when this is thoroughly dry, the aqua-fortis may be poured on again, to bite the other lines that are required to be deeper.

This process of stopping out and biting-in is to be repeated as often as there are to be lines of different degrees of thickness, taking care not to make any mistake in stopping-out wrong lines.

It is also necessary to be particularly careful to stop out, with the varnish, those parts from which the ground may happen to have come off by the action of the acid, otherwise you will have parts bit that were not intended, which is called *foul biting*.

When the biting-in is quite finished, the next operation is to remove the bordering-wax and the ground, in order that you may see what success you have had; for till then, this cannot be known exactly.

To take off the bordering-wax, the plate must be heated by a piece of lighted paper, which softens the wax in contact with the plate, and occasions it to come off quite clean.

Oil of turpentine is now poured upon the ground, and the plate is rubbed with a bit of linen rag, which removes all the ground. Lastly, it is cleaned off with whiting.

The success of the etching may now be known, but it is necessary to get an impression taken upon paper by a copper-plate printer. This impression is called a *proof*.

If any parts are not bit so deep as were intended, the process may be repeated, provided the lines are not too faintly bit to admit of it. This second biting-in the same lines, is called *re biting*, and is done as follows: Melt a little of the etching-ground on a spare piece of copper, and dab it a little, to get some on the dabber; then, having cleaned out with whiting the lines that are to be re-bit, heat the plate gently, and dab it very lightly with the dabber. By this, the parts between the lines will be covered with the ground, but the lines themselves will not be filled up, and consequently will be exposed to the action of the aqua fortis. This is a very delicate process, and must be performed with great care. The rest of the plate must now be varnished over, the bordering wax put on again, and the biting repeated in the same manner as at first.

If any part should be bit too deep, it is more difficult to recover it, or make it fainter: this is generally done by burnishing the part down, or rubbing it with a piece of charcoal. This will make the lines shallower, and cause them not to print so black.

Should any small parts of the lines have missed altogether in the biting, they may be cut with the graver; which is also sometimes employed to cross the lines of the etching, and thus to work up a more finished effect.

Dry-pointing, as it is called, is another method employed for softening the harsh effects usually apparent in an etching. This is done by cutting with the etching-point upon the copper without any ground or varnish, which does not make a very deep line, and is used for covering the light, where very delicate tints and soft shadows are wanting. By varying these processes of etching, graving, and dry-pointing, as is thought necessary, the plate is worked up to the full effect intended; and it is then sent to the *writing engraver*, to grave whatever letters may be required to be put upon it.

6. *Prussic acid.*

The prussic acid is produced by exposing the horns, hoofs, or dried blood of animals, with an equal quantity of fixed alkali, to a red heat.

The alkali is found to be neutralized by the acid thus formed, and, on evaporation, will yield a salt in crystals, which is

then called *prussiate* of *potash* or of *soda*, according to the alkali which has been employed.

These prussiates of alkali precipitate all metals from their solution, the alkali uniting with the acid which holds the metal in solution, whilst the prussic acid unites with the metallic oxyd, and communicates to it a peculiar colour.

Thus gold is precipitated of a yellow colour, lead of a white, copper of a brownish red, and iron of a dark blue, forming a prussiate of iron, or the substance called *Prussian blue*.

From this substance the prussic acid may be again separated, by digestion with pure alkali, the prussiate of alkali being again formed, and the iron left in the state of a brown oxyd. The *Prussiat of copper* has lately been prepared by Mr. Hachett, and is thought to be a valuable brown pigment.

This acid has a sour taste, and suffocating smell, but, except its capacity of combining with alkalis and metals, it manifests no conspicuous acid properties. It does not redden the most delicate vegetable blues. It has been found in Peach stones, and is a very violent poison.

7. *Nitric acid, or a permanent ink for marking linen.*

Silver with the nitric acid forms *nitrate of silver*, which is a colourless solution, and stains animal and vegetable substances with an indelible black colour; hence it is used as a *permanent ink* for marking linen; and is employed for dying human hair black, though, for this purpose, it should be used with great caution, and much diluted, as it is extremely *caustic* or *corrosive*. Nitric acid can dissolve more than half its weight of silver, the solution depositing crystals.

8. *To soften iron.*

Take half an ounce of tartar; two of common salt; and two and a half of verdigrease. Mix all together, and expose it in a poringer to the dew of nine nights running. This will turn into water, in which, when red hot, you may kill your iron.

9. *To melt iron so that it will spread under the hammer.*

Take equal quantities of lime, tartar, and alkali salt. Pour over it a sufficient quantity of cow-piss, to make a thick pap with it, which you will set a drying in the sun, or before the fire. Make an iron red hot in the fire; then plunge in that matter. You may afterwards melt it as you would silver, and then work it in the same way when cold.

10. *To give iron a temper to cut porphyry.*

Make your iron red hot, and plunge it in distilled water from nettles, acanthus, *and pilosella*, (or mouse-ears) or in the very juice pounded out of these plants.

11. *To soften all sorts of metals.*

Take sublimated mercury, euphorbium, borax, and ammoniac salt, of each equal parts pulverised. Project some of that powder over any metal, when in a state of fusion, and you will obtain the desired effect of making it soft.

12. *To soften a sophistic metal.*

Take black soap and common salt, of each two ounces; human excrements dried and pulverised, four ounces; roch alum an equal quantity, and nitre salt, half an ounce. Incorporate all together in a pan, over the fire, with bullock's gall; keep stirring it till you feel no longer any saline particle. Then take off the pan from the fire, and let the composition cool. Of this, you may throw some into the crucible in which your metal is in fusion.

13. *A good temper for arms:*

Take tythimalus, or spurge; roots of wild horse radish, bryonia, and purslain, of each equal quantities. Pound all together, so that you may get at least one pound of juice. Add to this, one pound of red haired child's water; saltpetre, alkaline, gem and ammoniac salts, of each one drachm. When you have mixed all well together in a glass vessel, close stopped, bury it in the cellar, and there let it lie for twenty days. Then bring it up again, and put it in a retort, to which you will adapt and lute well its receiver, and begin to distil by a gradual fire. Now when you want to get arms of a good temper, you have only to plunge them in this distilled liquor, after having previously made them red hot in the fire.

14. *To melt iron and make it soft:*

Take two pounds of auripigment, and four of oil of tartar. Make the auripigment soak up all the oil of tartar, and dry it up afterwards over a soft fire. Then put small bits of iron in a crucible; and when very red, throw by little at a time, about half a pound of that auripigment, prepared as before; and you will find your iron soft and white.

15. *To whiten iron like silver.*

Melt iron filings in a crucible, along with realgar, or red arsenic. Then take one ounce of that matter, and one of copper; melt all together, and put it in a coppel. It will give you one ounce of good silver.

16. *To render iron brittle, so as to pound like glass.*

Take the distilled water from roch alum, plunge in it seven different times your pieces of iron, or steel, beaten very thin, and made red hot every time. This operation will render them so brittle, that you may pound them in a mortar afterwards, as you could glass.

17. *Ingredients which serve to the melting of iron.*

Iron is to be melted with any of the following ingredients; *viz.*—pewter, lead, marcasite, magnesia, auripigment, antimony, crown glass, sulphur, ammoniac salt, citrine miriboláns, green, or fresh pomegranate rinds, &c. &c.

18. *To melt or calcinate the blade of a sword without hurting the scabbard.*

You must drop into the scabbard of the sword some arsenic in powder, and squeeze over it some part of the juice of a lemon. Then replace the sword into its scabbard. In a quarter of an hour afterwards, or little more, you will see what a surprising effect this will have.

19. *To fix mercury.*

Take verdigrease in powder, which put in a crucible. Make a hole in that powder, and place in it a knot of mercury previously impregnated with white of eggs water. Cover this knot over with borax, and add again over this some more verdigrease and pounded glass, one or two finger's deep. Lute well the lid of the crucible, and give a pretty smart fire, though gradually and not at once, for the space of two hours.

20. *To refine pewter.*

Take fine pewter, and put it into a crucible. When melted project over it, at different times, some nitre, till it comes to a perfect calcination. Repeat this three times, pounding the matter into powder, which mix with charcoal dust. Being thus melted, it will resume its former substance of pewter, with this difference, that it will be refined to an infinitely superior degree.

21. *A spirit which will dissolve all sorts of stone.*

Take rye-flour, and make small balls with it, which you will dry then put them into a retort well luted, and place it over a gradual fire, to draw the spirits by distillation. Any stone whatever will dissolve in it.

22. *To extract mercury from lead.*

Take lead and beat it into sheets, or laminas, very fine. Put these in a glass vessel with common salts, a double quantity of the lead. Cover this well, and bury it under ground for nine days at least. After that time, if you open the vessel again, you will find your lead turned all into running mercury or quicksilver, at the bottom of it.

23. *The compositions of cast mirrors and cylinders.*

Take one pound and a half of red copper, eight ounces of refined pewter, one and a half of stellated mars-regulus, otherwise regulus of antimony, half an ounce of bismuth, one and a half of nitre, and a discretionable quantity (that is to say, as much as you please) of silver.

24. *To give tools such a temper as will enable them to saw marble.*

Make the tool red hot in the fire, and, when red cherry colour, take it off from the fire, rub it with a piece of candle, and steep it immediately in good strong vinegar, in which you shall have diluted some soot.

25. *To soften iron, and harden it afterwards more than it was before.*

1. Make a little chink lengthways in an iron bar, in which pour melted lead. Then make it evaporate by a strong fire, as that for copelling. Renew this operation four or five times, and the bar will become very soft. You harden it afterwards in steeping it, when red hot, in mere forge water, and it will be of so good a temper, as to be fit for lancets, razors and knives, with which you will be able to cut other iron, without its splitting or denting.

2. It has been found, by experience, that an armour can never be good proof against fire arms, if it has not first been softened with oils, gums, wax and other incerative things, and afterwards hardened, by steeping them several times over in binding waters.

26. *The transmutation of iron into damask steel.*

You must first purge it of its usual brittleness; and, after having reduced it into filings, make it red hot in a crucible; steep it several times in oil of olives, in which you shall have before thrown several times melted lead. Take care to cover the vessel in which the oil is contained, every time you throw your steel into it, for fear the oil should catch fire.

27. *To guard iron against rusting.*

Warm your iron till you can no more touch it without burning yourself. Then rub it with new and clean white wax. Put it again to the fire, till it has soaked in the wax. When done, rub it over with a piece of serge, and this iron will never rust.

28. *To cut pebbles with ease.*

Boil it a good while in some mutton suet, and then you will cut it very easily.

29. *A projection on copper.*

1. Take fine pewter two ounces, which you will melt in a crucible. When melted, throw in it by little at a time, the same weight of flour of brimstone. Stir every time with a rod, till you see both your pewter and sulphur well calcinafed. Then take the crucible out of the fire, and throw in half an ounce of crude mercury. Let it cool, and pulverise this.

2. Now melt four ounces of molten copper. When in good fusion, project on it, by degrees, one ounce of the above powder, stirring carefully, while you do it, with a stick. Leave it thus in fusion for a little while, and then you may use it for making all sorts of plates. It is so beautiful, that, if you test it on the coppel with lead, it will stand it perfectly.

30. *The preparations of emery.*

1. Calcine eastern, or Spanish emery, three or four times in the fire; then let it cool. Pound it and make *strata super strata* of it, with double the quantity of sulphur-vivum in powder. Leave this crucible in the furnace with a strong fire during three or four hours. Repeat this process four different times over, then reduce your emery into an impalpable powder. Put it next into a matrass, pour over it regal water, that it swim over by three fingers deep. Put this in digestion for eight hours. Pour off by inclination your regal

water, impregnated with the dye. Put new water on your matter, and set it on digesting again for eight other hours, as the former. Then take your thus tinged waters, which you will mix and put in a retort. Distil most part of it, till you see what remains in the retort is yellow. This is the true oil of emery, in which you put the bigness of a filbert of camphire.

2. Exsulphurate in a crucible, on a good fire, and during two hours, what quantity you please of arsenic. Then take two ounces of the aforesaid oil of emery, one of your exsulphurated arsenic, an equal quantity of salt of tartar drawn with distilled vinegar, two of sublimate, and two of silver; which you will have dissolved in an *aqua fortis* made with nitre and vitriol. Put all together in a matrass, so large that the composition should occupy no more than a third part of it, of which you shall have cut the neck off, to obtain a more easy evaporation of the compounds from it. Put this matrass in the sand as high as the matter, and give it a moderate fire for two hours, then a strong one for six; let the fire go out of itself. Then you will find your matter in a stone in the matrass. Take it out, and pound it into powder, projected upon another ounce of salt in fusion; if you keep it a little while in that state, and throw it afterwards into oil of olives, will increase your gold by a third of its primary quality, and rather more: And you may thus increase it again and again, by repeating the same operation.

31. *To render tartar fusible and penetrating.*

1. Stratify cakes of white tartar with vine branches. When done, set them on fire by the top, and when arrived at the bottom, your tartar will be calcinated.

2. Dissolve this calcined tartar in *aqua vitæ*, then pass it through the filtering paper, and next evaporate the brandy. What shall remain is the salt of tartar, which you must find to be as white as snow. Pour over it the best French spirit of wine, so that it should exceed over the salt the thickness of an inch. Set it on fire. As soon as your spirit of wine shall be all consumed, your salt of tartar will be fusible and penetrating.

3. Now should you make any iron red hot, and project on it a little of that salt, it will penetrate it through and through, and leave after it a vestige as white as silver, in the place where it touched.

32. *To break an iron bar as big as the arm.*

Take melted soap, with which you will rub your iron bar at the place where you would have it break. Then with any thing take off and clean away part of that unction, in the

middle of it, about the width of half-a-crown. Then take a sponge dipt into ardent water of three distillations, bring it round the bar, and in six hours it will break.

33. *To compose a metal of a gold colour.*

Take refiner's copper six ounces; melt it in a crucible; add one once of calaminary stone; half an ounce of tutty, and one of *tera merita*, in powder. Give to this a melting fire for five or six hours running, then take off the crucible from the fire. Put this composition in powder, and add to it two ounces of common mercury, six of sea salt exsicated, and a sufficient quantity of water. Set the whole a boiling, until there appear no more mercury. Then put the matter into a crucible, and place it between two fires of kindled coals, avoiding carefully the breathing of the fumes. Give this a melting fire, for two hours, then wash the composition in water, till this runs off quite clear. Set this again in the crucible; and, when melted, pour it into an ingot. This will give you a metal, of the most beautiful gold colour, which you may make use of for plates, buckles, snuff-boxes, cane-heads, &c.

34. *Another composition of metal*

Take a reasonable quantity of the leaves of *Persicaria urens*, called *Arsmart*, or vulgarly Water-pepper, which you will dry in the shade. Melt in a crucible six ounces of refiners copper, and when melted, throw in one ounce of powder of the arsmart's leaves, or even half an ounce; then cover the crucible with an iron lid, and keep this matter in fusion for the space of one hour, after which you cast it in an ingot. This progress will give you a metal which (except the colour that artists can at any time give it by an industry well known to them) has otherwise all the qualities of gold. The only defect is, that it cannot bear testing, and that it must therefore serve only to supply common copper which rust easily, and has not so much brightness. It may be used for candlesticks, and other similar works.

We thought it was proper here to give this receipt, as it is to be wished we could make oureselves those metallic compositions which we import from Holland, and other countries.

35. *To dissolve gold in your naked hand.*

Distill hart's blood just killed; and after having drawn the spirits *per ascensum* in *baleno-mariæ*, cohobate again three different times. At the third distillation you sublime all the fixt;

and when done, lute well the vessel, and keep the liquor for use. This liquor, carefully preserved, will dissolve gold in the naked palm of the hand.

36. *To melt metals in the shell of a nut without burning it.*

Take saltpetre two ounces; sulphur half an ounce; oak, walnut-tree, or any other dry wood sawdust half an ounce. Let the sawdust be sifted very fine, and the saltpetre and sulphur reduced to an impalpable powder. All this being well mixed together, fill the shell of a nut with it to the brim; then lay it over a piece of gold, silver, or any other metal you please; and, having covered it again with the same powder, set the fire to it, and you will see that the metal will melt and remain at the bottom of the shell.

37. *Fixation of saltpetre.*

Melt some lead in a crucible, and project on it pulverised nitre, reiterating the projections in proportion as the matter fuses, till it is entirely melted.

38. *Transmutation of iron into copper.*

Iron is easily changed into copper by means of the vitriol. To do this, put your iron, *stratum super stratum*, in a descensorium, and set it over a strong blast fire, pushed by bellows, till the iron melts and flows into copper. You must not forget, when you have made your beds of vitriol, to water them a little over with vinegar saturated of saltpetre, alkaline, and tartar salt, and verdigrease.

39. *To preserve the brightness of arms.*

Rub them with hart's marrow. Or else, dissolve some allum powder with the strongest vinegar you can find (that of *Montpellier*, which serves to make their famous verdigrease, is the fittest) and rub your arms with it. By these means, they keep for ever bright and shining.

40. *To manage steel so, that it may cut iron as it were lead.*

Draw, by an alembic, the water which will come from a certain quantity of earth-worms; join with this water an equal quantity of horse radish juice. Then temper, four or five times, in this liquor, your iron kindled red hot. That sort of steel is made use of for knives, swords and other instruments with which you may cut iron with as much ease as if it were lead.

41. *To soften steel.*

Take a discretionable quantity of garlic, rob them of their coarest peel, then boil them in oil of nuts, till reduced into an *unguentum*. Cover well your steel all over with that composition, to the thickness of half a crown. When this is done, put your steel, thus covered, in the forge, in the live coals, and it will become soft. To restore it afterwards to the temper, called by artists *red cherry colour*, you must, after having made it red hot, plunge it in the coldest water.

42. *To extract mercury from antimony.*

Take antimony and decrepitate salt, of each one pound. Mix them together, and put in a retort of two quarts. Set the retort on the bare fire, or on the gradual sand fire. Let the beak of the retort be in the water, and at the bottom of that vessel, wherein the water is, you will find the running mercury of antimony.

43. *A fixation of copper, which will be found to yield six ounces out of eight, on the test.*

Take two ounces of fine pewter, which melt in a crucible, adding gradually to it, after it is melted, an equal quantity in weight of flour of sulphur. When all is calcinated, and while still a little warm, add again to it half an ounce of common purified mercury, stirring continually with a spatula, till the mercury disappears entirely. There will come a powder, of which if you project one, on four ounces of red copper in fusion, then stir and cast in ingots, you may obtain the promised advantage.

44. *To whiten copper so as to make very fine figures with it.*

Take five parts of copper, which you will melt in a crucible, then throw in one part of zinc. As soon as the zinc is in it, take it off from the fire, and stir the matter a little with an iron rod, then cast it in the moulds of your figures. They will look like silver casted ones.

45. *To give the finest colour of gold to copper, in order to make statues, or other works with it.*

Take one pound of copper, melt it in a crucible, then throw in it one ounce of Alexandrian tutty reduced into a subtile powder, and mixed with two ounces of bean-flour. Take care to keep stirring this matter, and to guard yourself

against the fumes. After two hours of fusion, you will take this composition off, and wash it well, and put it again in the crucible with the same quantity as before of the same powders. When melted, for this second time, you may take it off, and cast it in the moulds you propose, and had prepared for it.

46. *To imitate tortoiseshell on copper.*

Rub copper laminas over with oil of nuts, then dry them over a slow fire, supported by their extremities upon small iron bars.

47. *To perform the same on horn.*

Make a cold dissolution of auripigment in filtered lime water; then, lay some of this liquor with a brush on your comb or other horn work. Reiterate this, if you find it has not penetrated enough the first time, and turn it, to do the same on the other side.

48. *To soften metals.*

Take saltpetre and camphire equal parts. Dissolve them in a lye made with two parts of oak-wood ashes and one of quick lime. Pass this solution through a filtering paper, and vaporise it over a slow fire in a glass vessel. There results a borax, which, thrown in metals while in fusion, softens them perfectly.

49. *A secret fire.*

Have a barrel open by one end, and pierced with a dozen of holes on the other. Put in it three or four bushels of oat-straw, cut very fine, as that which is given to horses. Get next half a bushel of barley, which have soaked for three days in lime water, and drained in a sheercloth of all the water which can run out of it. Place this wet barley in a lump over the oat straw, then cover it with other similar cut straw, and let it rest, when you thrust your hand in it, you feel it warm. This heat you may keep up, by throwing, with a gardener's watering-pot, about half a pint of water every other day.

50. *To solder iron, or any other metal without fire.*

Take one ounce of ammoniac, and one of common salts; an equal quantity of calcined tartar, and as much of bell-metal, with three ounces of antimony. Pound all together and sift it. Put this into a piece of linen, and inclose it well all round with fuller's earth, about one inch thick. Let it dry, then put it between two crucibles, over a slow fire to

get heat by degrees. Push on the fire till the lump contained in the crucibles becomes quite red hot, and melt all together. Then let the vessels, and the whole, cool gradually, and pound it into powder.

2. When you want to solder any thing, put the two pieces you want to join on a table, approaching their extremities as near as you can one to another. Make a crust of fuller's earth so, that holding to each piece, and passing under the joint, it should be open over it on the top. Then throw some of your powder between and over the joint. Have again some borax, which put into hot wine till this is consumed, and with a feather rub your powder at the place of the joint; you will see it immediately boiling. As soon as the boiling stops, the consolidation is made. If there be any roughness you must smoothen it, by rubbing with a grinding stone, for the file will have no power over it.

51. *To solder with fire.*

Make a paste with pulverised chalk and gum water, which put around the two broken pieces placed on a table and prepared as before-mentioned in the preceding receipt. The only difference is, that you are to rub over the two united extremities with melted soap; and, after having thrown some of the above powder at the place of the joint, hold a kindled piece of charcoal over it. This will immediately set the matter in fusion, which is no sooner done, but you may take off the paste, and you will find it consolidated.

52. *An oil, one ounce of which will last longer than one pound of any other.*

Take fresh butter, quick lime, crude tartar, and common salt, of each equal parts, pound and mix together. Saturate it with good brandy, and distil it in a retort, over a graduated fire, after having adapted the reciver, and luted well the joints.

53. *To make borax.*

Take two ounces of roch-alum, dilute it, and mix it with two ounces of alkaline salt, which is used in making of glass. Put all into a pewter pot, and set it a-doing, for the space of half an hour, over a gentle fire; then take it out of the water. Take next two ounces of gem salt in powder, as much of alkaline salt, two pounds of virgin honey, and one of cow milk. Mix well all together, and set it in the sun for three days. Then the *borax* is done.

54. *To render iron as white and beautiful as silver.*

Take ammoniac salt in powder, and mix it with an equal quantity of quick lime. Put them all together into cold water, and mix well. When done, any iron piece, which you shall have made red hot, will, if you steep it in that prepared water, become as white as silver.

55. *To calcine pewter, and render it as white and hard as silver.*

Melt well your pewter in a crucible, so that it may be very fine and clear. Pour it afterwards into a very strong vinegar, then into mercurial water. Repeat that operation as many times as you please, you will each time give it an additional degree of hardness and whiteness, drawing near to silver; so much, that it will at last be very difficult to distinguish it from silver itself.

56. *To whiten brass.*

1. Take rosin and saltpetre, equal quantities. Pound all in a mortar, and reduce it into an impalpable powder. Put this into an earthen pan made red hot, and thus burn the matter. As soon as done, you must wash and dry it, then grind it again as before, with the addition of an equal quantity of auripigment. Then put all this into a crucible, cover it with another well luted, and having a little hole in the top, which you will stop by laying only a medal on it. When calcined, take what you will find clear in the bottom, not what will have sublimed on the top. Make a very fine powder of this matter; and, with *one* single ounce of that powder, you will be able to whiten two pounds of brass, in proceeding about it as follows.

2. Melt first your brass as usual; and when in good fusion, cast it into very good vinegar; an operation which you must repeat three times. Then, when you melt it for the fourth time, you are to project on it, as we said before, *one* ounce only (if you have two pounds of brass) of the said powder, which will render your brass as white as silver.—*N. B.* To melt the brass with more facility, throw in the crucible a certain discretionable quantity of mice-dung.

57. *A black varnish.*

1. Take gum-lac, four ounces; sandarak and black rosin, equal quantities, one ounce of each. Pulverise all separately, and keep them distinct, to proceed afterwards in their mixture according to the following directions. Dissolve the rosin over

the fire in a sufficient quantity of spirit of wine, then add the sandarak to it. As soon as this is dissolved, add the powder of gum-lac, and stir well till all is melted together. Strain it, while warm, through a cloth. If any thing remain in the linen afterwards, add some more spirit of wine, to dissolve it as before, and strain it again.

2. The black colour is given to it by means of *two drachms* only of ivory black to every *two ounces*.

58. *To make ivory black for the above purpose.*

Burn any quantity of ivory you please, in the fire, till it is black. Put it into powder on a stone of porphyry. Add some water to it, and make a paste, which you let dry. Then grind it again, as before, with spirit of wine.

59. *Chinese varnish, particularly calculated for miniature painting.*

Take one ounce of white *karabe*, or amber; and one drachm of camphire, reduced into a subtile powder, and put in a matrass, with five ounces of spirit of wine. Set it in the sun to infuse, during the hottest days, stir it two or three times a-day. After a fortnight's infusing thus, put the matrass, for one hour, over hot ashes; then pass all through a cloth, and keep it in a bottle well corked.

60. *How to make a red, with varnish of a much higher hue than coral itself.*

Take Spanish vermillion, grind it on a marble with brandy, and add to it the sixth or eight part of lac. When done, mix this composition with as much varnish as you may find it requisite to apply.

61. *To make sashes with cloth which will be very transparent.*

Take fine white cloth; the finer, the more transparent the sashes will be. Fix the cloth very tight on a frame. Then make some starch with flour of rice, and lay a coat of it, as smooth as you can, on both sides your cloth, with a stiff brush; let it dry. Then the following varnish, with a soft brush, having care to lay it on as equally as possible.

62. *The varnish fit for the above sashes.*

1. Take of the finest and whitest wax you can find, six pounds; of the finest and clearest Venice turpentine, two;

one and a half of the most perfect lintseed oil. Have a new and varnished pipkin, larger at least, by one third, than is requisite to contain all these ingredients. Put first, in this pot, the lintseed and turpentine oils together, and set it over a small charcoal fire.

When this begins to be a little warm, put in the wax, cut in small bits, and take care to mix all well with a clean stick, till the wax is throroughly incorporated with the rest.

2. Now take the pot off from the fire; and, while this composition is still a little warm, give a coat of it on both sides, prepared as before directed, and let it dry in the shade.

Note. You may render your sashes still more transparent, if, on both sides of them, you lay a smooth coat of the following varnish, with a soft brush.

63. *A fine white varnish.*

Take one pound of fine Venice turpentine, and as much of spirit of turpentine. Put this in a glass matrass, larger at least by a third, than is wanted to contain the matter. Stop this matrass with another smaller matrass. The neck of which is to enter into that of the former. Have care to lute well both necks together, with paste and paper; and when the luting has acquired a perfect dryness, set the first matrass on a sand bath, then set the varnish a-boiling, for near an hour, after which, take it off from the fire, and let it cool. When cold, bottle and stop it for use.

Note. Turpentine well purified from all its greasy parts, is the best, and fittest to make the varnish for sashes.

64. *A varnish to prevent the rays of the sun from passing through the panes of window-glasses.*

Pound gum adragant into powder, and put it to dissolve for twenty-four hours, in whites of eggs, well beaten. Lay a coat of this on the panes of your windows, with a soft brush, and let it dry.

65. *To render silk stufs transparent, after the Chinese manner; and paint them with transparent colours likewise, in imitation of the India manufactured silks.*

Take two pounds of oil of turpentine, very clear; add to it two ounces of mastich in grain, and the bulk of a filbert of camphire. Let this dissolve by a gentle heat; then strain it through a cloth. Of this oil lay one coat, or two, on both sides of your stuff. Allow, however, a sufficient time between each coat, for each to dry, and let the second lie two days on before you touch the stuff again. When that time is over,

draw the outlines of your design, and flowers, &c. cover this with a preparation of lamp-black and gum-water. Then fill the intervals with the intended and proper colours, suitable to the purpose, and which ought to be all transparent colours, diluted with a clear varnish. When this is done, and dry, lay on both the right and wrong sides of the stuff another coat of clear varnish.

66. *To make a transparent blue hue, for the above purpose.*

Take nine drachms of ammoniac salt; six of verdigrease, distilled and exsiccated. Put both these into powder; dilute these powders with tortoise oil. Put this on a very thick glass, which stop well, and set over hot ashes for a week. After that time your colour will be fit for use, and make your drawings with the clear varnish, as directed in the preceding article.

67. *To make a transparent yellow hue, for the same use.*

Take a new-laid egg of that very day, make a hole in the shell, to draw the white out of it. Replace, by the same hole, with the yolk, two drachms of quicksilver, and as much of ammoniac salt; then stop the hole with wax. Set that egg in hot dung, or over a lamp fire, for four or five and twenty days. When that time is over, break the egg, and you will find a very fine transparent yellow, fit for the use above mentioned.

68. *To give the abovementioned painted silks all the smell and fragrancy of the India ones.*

It is well known, that the silks, and other things, we receive from India, are all tainted with a certain particular smell, and agreeable fragrancy, which being their peculiar, distinctive, and most obvious character, if not imitated also, would help not a little in ruining the deception intended by the above labour. To imitate therefore, even this, you must observe the following direction—Have a small closet, if it be for works at large; or only a fine basket with a top to it, playing upon hinges, stuffed and lined all over in the inside, if it be for one single piece of silk. Put in either of them, and according to their extent, a proportionable quantity of cloves, whole pepper, mace, nutmeg, all-spice, camphire, &c. &c. Put your works among those ingredients and keep either the closet, or the basket, perfectly close shut, till you see they

have received a full impression from the odour of those ingredients.

N. B. With the various compositions of varnishes and preparations of colours, we have just given, there is almost no sort of works, coming from the Indies, but can be performed and imitated.

69. *The true receipt of the English varnish, such as is laid on sticks and artificial made canes.*

Smoothen and polish well your sticks; then rub them, or your artificial made canes, with a paste made of flour. Then having diluted, in water, a discretionable quantity of Flemish glue, and red orpine, give one coat of this, very smooth and equal, to your sticks. If, after this is dry, you do not think it sufficient, give them another, and let them dry. Then, give them a third coat, of clear varnish, made with turpentine and spirit of wine. After this is done, put a soaking in an equal quantity of water and chamber-lye, some turnfol cut very small. With this colour you touch your sticks, or canes, here and there, with a hair brush. Then holding them perpendicular, on their small ends, between both your hands, you roll them quick and brisk (as when you mill chocolate) in contrary senses. This operation gives them a negligent and natural-like marbling, over which you are to lay another coat of varnish, and set them to dry.

70. *A varnish to lay on, after the isinglass.*

Take spirit of wine, four pounds; white amber, fourteen ounces; mastich, one; sandarak, seven. Put all in digestion, for twenty-four hours. Then, set the matrass on the sand, and give the fire for three hours, till all is perfectly dissolved. Add after four ounces of turpentine oil.

71. *A varnish water proof.*

Take lintseed oil, the purest you can find, put it in a well glazed pipkin, over red-hot charcoals, in a chafing dish. With that oil add, while a warming, about the fourth part of its weight of rosin. Make all dissolve together, and boil gently, lest it should run over the pot. At first, the oil will turn all into a scum; but, continuing to let it boil, that scum will insensibly waste itself and dissappear at last. Keep up the fire till taking a little of that oil, with a stick, you see it draw to a thread, like as varnish does. Then take it off from the fire. But if, trying it thus, it prove too thin, add some more rosin to it, and continue to boil it.

2. When it is come as it ought to be, varnish whatever you want with it, and set it in the sun to dry, or before the fire, for it cannot dry without the assistance of either of these.

N. B. This composition of varnish has this particular property, viz. that, if you lay it on wooden wares, hot water itself cannot hurt it, nor have the least power on it. You may, therefore, make a very extensive use of it. But you must take care to choose the finest and the most perfect rosin, and to boil it well, for a long time. Quære, *Would not such a varnish be extremely useful, to preserve what is much exposed to the injuries of the weather in gardens and elsewhere; such as sashes, statues, frames, hot-houses, &c.?*

72. Callot's *varnish.*

1. Take two ounces of the finest lintseed oil; benjamin, in drops, two drachms; virgin wax, the bulk of a filbert. Boil all this together, till it is reduced to one third; and, while it is a boiling, never cease to stir with a little stick. When done, bottle, or put it in a large mouthed vessel.

2. To use that varnish, warm a little the plate you intend to engrave upon; and, taking a little of the varnish with the tip of your finger, spread it delicately over the plate. Observe to put as little of it as you can, and to lay it on as smooth and as equal as possible. When done, smoke the plate, on the varnished side, with a candle, passing and repassing it gently, over the flame of it, till it is black every where. Set it again, now, on the chafing-dish, wherein are kindled charcoals; and, when the plate has done fuming, then the varnish is sufficiently hardened. You may then chalk, draw, and etch, whatever you will on it.

Such is the true receipt of the varnish, which the famous *Callot* made use of, to engrave his most admired and truly admirable subjects.

73. *A varnish to lay on paper.*

Begin by laying on your paper one first coat of very clear and thin size. This being dry, melt three parts of oil of spike and one of rosin together; and, when come to the consistence of a varnish, you lay one second and light coat of this over the first made with size. This varnish is very fine, when very smoothly and equally laid on.

74. *To imitate porphyry.*

Take English brown red, if too red, add a little umber to it, or some soot. Pound all into powder. Then have a marble stone, of a fine polish, which over-lay with oil. Make a col-

our composed of brown red, and a little flat, or Venetian lake, previously grinded with gum adragant. Then, with a largish brush, take of that colour, and asperse oiled marble with it, by striking the handle of the brush on your wrist (as book-binders stain the covers of their books.) When your marble shall have been thus well speckled all over with that red colour, you let it dry. Then taking your lump of brown red and umber, dilute it, make a thin paste of it, and lay it on your speckled marble. When this is also dry, it admits of a very fine polish, and looks like porphyry.

75. *A subtile mastich to mend all sorts of broken vessels.*

Take whites of eggs, and beat them well to a froth. Add to this soft curd cheese, and quick-lime, and begin beating a-new all together. This may be used in mending whatever you will, even glasses, and will stand both fire and water.

76. *A glue to lay upon gold.*

Boil an eel's skin, and a little quick-lime together; when boiled gently for the space of half an hour, strain it, and add some whites of eggs beaten; bottle, and keep it for use. The method to use it afterwards, is to warm it, and lay a coat of it on marble, delph, Worcester, Stafford, or any other earthen wares, &c. and when nearly dry, write, paint, or draw what you please on it with a pencil, and gold in shell.

77. *A cold cement for cisterns and fountains.*

Take litharge and boil in powder, of each two pounds; yellow ochre and rosin, of each four ounces; mutton suit, five ounces; mastich and turpentine, of each two ounces; oil of nuts, a sufficient quantity to render maleable. Work these all together; and then it is fit for use.

78. *A lute to join broken vessels.*

Dissolve gum arabic in chamber-lye over a chafingdish; stir with a stick till perfectly dissolved, then add an equal weight of flour, as you had of gum arabic, and concoct the whole for one quarter of an hour, or more, if requisite.

79. *To make sealing wax.*

Take shell-lac, &c. pound them all into a very fine and impalpable powder. Then have two wooden pallets present upon them, before the fire some powder of one sort to melt, then move and stir it with the said pallets. Take again of another powder in the same manner, and mix it in the same way

before the fire with the first. Then another and another, till they are all by this method, perfectly well amalgamated together.

2. Have now some cinnabar in powder, which put in a pan with water. In that water and cinnabar powder, set to infuse, or only touch your incorporated gums, to make this composition take colour. When thus sufficiently coloured, take it out of the water with both your hands and the wooden pallets, and have a person to help you. This having wetted his hand, will draw some of the said gum, and handling it on a table, will form the sticks. For two pounds of gums, two ounces of cinnabar are wanted.

80. *An excellent sealing wax by* Girardot.

Put four ounces of rosin, and four and a half of whitening, and melt them together in a non-varnished pipkin, over kindled coals. While this is in fusion, have another pot, similar to this, in which you keep two ounces of shell-lac, in dissolution with vinegar. Now steep a wooden stick in the first pot, and another in the other pot; then, over a chafingdish, turn quickly, one over another, the ends of your two sticks together, to mix and incorporate well what matter they shall have brought along with them from each pipkin. And after having turned them thus a reasonable time, you see both matters are well embodified, steep them, at different times, in a prepared liquor to colour them.

81. *A cement to render crystal like diamonds, and give the sapphires of Alenson a hardness to cut glass with ease.*

Make a strong dough with sifted barley flour and petroly, (or rock-oil.) Divide this paste in two equal parts. In one of them range your stones, so that they should not touch one another. With the other part of your paste cover this. Wrap up the whole with a good lute, and give it a wheel fire for four or five hours, gradually increasing the strength of the fire between every two hours. Then you will have a lump of stones, which will sparkle like true diamonds.

82. A *paste, which will produce as beautiful emeralds as natural ones.*

Calcine, six different times, rock crystal, and plunge it, as many times, in pure cold water. Grind it into powder, on a rock crystal stone, with a mullar of the same. When you have rendered the powder very fine and impalpable, to one

pound of it, add another of salt of tartar, drawn from red tartar, mixed well. Join to this, 60 grains of red copper, and fifteen of silver, both in shell, but grinded separately. Now mix the last powders with the former, on a marble stone, and put all together in a clean and double heated crucible. Lute it well with its lid, and, when the lute is perfectly dry, put the crucible for six days on a clear, but gentle fire; then increase the fire till the crucible becomes red hot, place it immediately in the ardent and glass melting furnace, and keep it there in the same degree of heat for a month, without interruption. Then let the crucible cool gradually in the furnace, which is done by letting the fire go out of itself, having previously stopped all the holes and openings of the furnace. When you break it, you will find a beautiful green, which is fit to cut by the lapidary.

Note. Be careful of this composition, for it has all the merit and advantage of the true *emerald.* It vies with it in weight, colour, and hardness. In short, the greatest connoisseurs cannot distinguish these emeralds from the finest real ones.

83. *To soften crystal.*

Redden it in the fire, and when full of fire, plunge it in mutton and lamb's blood, mixed and warmed together. Reiterate this two or three times, and it will be soft.

84. *To counterfeit diamonds.*

1. Melt by means of fire, some transparent pebbles. Grind them next into a very fine powder, then set this powder again a-melting on the fire. Put your stones afterwards in a paste of barley flour, and bake under ashes, the diamonds will be done.

2. To give them a proper water, nothing else is to be done but put them in *aqua vitæ*, which having set fire to, let burn out entirely. By that operation they acquire the right colour of diamonds.

85. *A composition, the fundamental basis of all enamels.*

1. Grind on marble, and sift through a very fine sieve, equal quantities of lead and pewter-calx. Put it in a varnished pipkin filled over with water. Boil it some while; then pour it by inclination, into another vessel. Put new water, to boil again over the calx, and decant it as before, on the first water: which process you repeat till you have entirely dissolved all the calx. If some part of the metal remain at the bottom, too gross to be entirely carried by the

waters, it must be put in a melting-glass furnace to calcine, having care to take out, in proportion as it turns into calx, the upper part of the matter. When it is all calcined, continue dissolving it, by means of boiling water, as you did the first. When you have got all your waters of dissolution, vaporise them over a slow fire; and particularly towards the end of the evaporation, have a singular care that the fire be not too fierce, which then remains at the bottom, very fine and subtilized.

To twenty-five pounds of this calx add an equal weight of frit, made of tarce, or white sand, well pounded and sifted through a very fine sieve, and four ounces of white salt of tartar, pounded and sifted in the same manner. Put these ingredients in a melting-glass furnace; melt and purge them there for ten hours. Then having taken the pot off from the fire take out the matter, which, after having well pulverised, keep it in a close dry place, where dust cannot come at it.—Such is the first and principal matter to be used in the composition of enamels, of whatever sort of colour you want to make them.

86. *Precipitating Silver by Copper.*

Copper has a much greater affinity with oxygen than silver; consequently, the silver is precipitated from its solutions as a fine *silver dust*, by metallic copper. This likewise affords a means to discover what portion of silver may be contained in an alloy of silver and copper. A quantity of the mixture determined by weight is dissolved in nitric acid; the solution is diluted with water, filtered, and a plate of copper hung in it, till no more precipitate falls down. Then the weight of the precipitate, when edulcorated, is compared with that of the whole alloyed metal put to trial.

This silver dust well washed, and mixed with gum-water, serves as a pigment in water painting.

87. *Separating Silver from Copper by an Alkaline Sulphuret.*

The affinity of copper with sulphur is stronger than that of silver. Upon this ground, liver of sulphur (sulphuret of pot-ash) has been proposed as an expedient to free silver from copper; for if silver holding copper be fused with alkaline sulphuret, the base metal combines with the latter, and is converted into scoriæ floating on the silver.

88. *Mr. Keir's mode of separating Silver from Copper.*

Chemists have long been acquainted with the compound acid, called aqua regia (nitro muriatic acid,) which has the

exclusive property of dissolving gold. The discovery of a compound acid, acting exclusively upon silver, is owing to our cotemporary, Mr. KEIR.

This compound acid is made by dissolving one pound of nitrate of pot-ash (common nitre or salt-petre,) in eight or ten pounds of sulphuric acid (oil of vitriol,) or by mixing together sulphuric and nitric acids. This acid dissolves silver easily, while it will not attack copper, iron, lead, gold, or platina.

89. *A Varnish for rendering Silk water and air-tight.*

To render the linseed-oil drying, boil it with two ounces of sugar of lead, and three ounces of litharge, for every pint of oil, till the oil has dissolved them; then put a pound of bird-lime, and half a pint of the drying oil, into a pot of iron or copper, holding about a gallon; and let it boil gently over a slow charcoal fire, till the bird-lime ceases to crackle; then pour upon it two pints and a half of drying oil, and boil it for about an hour longer, stirring it often with an iron or wooden spatula. As the varnish, in boiling, swells much, the pot should be removed from the fire, and replaced when the varnish subsides. While it is boiling, it should be occasionally examined, in order to determine whether it has boiled enough. For this purpose, take some of it upon the blade of a large knife, and after rubbing the blade of another knife upon it, separate the knives; and when, on their separation, the varnish begins to form threads between the two knives, it has boiled enough, and should be removed from the fire. When it is almost cold, add about an equal quantity of spirits of turpentine; mix both well together, and let the mass rest till the next day; then having warmed it a little, strain and bottle it. If it is too thick, add spirits of turpentine. This varnish should be laid upon the stuff when perfectly dry, in a luke-warm state; a thin coat of it upon one side, and about twelve hours after, two other coats should be laid on, one on each side; and in twenty-four hours the silk may be used.

90. *Mr. Blanchard's Varnish for Air-ballons.*

Dissolve elastic gum (Indian rubber,) cut small, in five times its weight of spirits of turpentine, by keeping them some days together; then boil one ounce of this solution in eight ounces of drying linseed-oil for a few minutes, and strain it. Use it warm.

91. *To dissolve Gum-Copal in Spirits of Wine.*

Dissolve half an ounce of camphor in a pint of alkohol, or spirits of wine; put it into a circulating glass, and add four

ounces of copal, in small pieces; set it in a sand-heat so regulated, that the bubbles may be counted as they rise from the bottom; and continue the same heat till the solution is completed.

Camphor acts more powerfully upon copal than any other substance. If copal is finely powdered, and a small quantity of dry camphor rubbed with it in the mortar, the whole becomes in a few minutes a tough coherent mass. The process above described will dissolve more copal than the menstruum will retain when cold. The most economical method will therefore be, to set the vessel which contains the solution by for a few days; and when it is perfectly settled, pour off the clear varnish, and leave the residuum for a future operation.

This is a very bright solution of copal; it is an excellent varnish for pictures, and may perhaps be found to be an improvement in fine japan w[illegible], as the stoves used in drying those articles may drive off the camphor entirely, and leave the copal pure and colourless upon the work.

N. B. Copal will dissolve in spirit of turpentine, by the addition of camphor, with the same facility, but not in the same quantity, as in alkohol.

92. *A Varnish for Toilet Boxes, Cases, Fans, &c.*

Dissolve two ounces of gum-mastich, and eight ounces of gum-sandarach, in a quart of alkohol; then add four ounces of Venice turpentine.

93. *A Varnish for Violins, and other Musical Intsruments.*

Put four ounces of gum-sandarach, two ounces of lac, two ounces of gum-mastich, an ounce of gum-elemi, into a quart of alkohol, and hang them over a slow fire till they are dissolved; then add two ounces of turpentine.

94. *Seed-lac Varnish.*

Take spirits of wine, one quart; put it in a wide mouthed bottle, add thereto eight ounces of seed-lac, that is large grained, bright, and clear, free from dirt and sticks; let it stand two days, or longer, in a warm place, often shaking it. Strain it through a flannel into another bottle, and it is fit for use.

95. *Shell-lac Varnish.*

Take one quart of spirits of wine, eight ounces of the thin-

nest and most transparent shell-lac, which, if melted in the flame of a candle, will draw out in the longest and finest hair; mix and shake these together, and let them stand in a warm place for two days, and it is ready for use. This varnish is softer than that which is made from seed-lac, and therefore is not so useful; but may be mixed with it for varnishing wood, &c.

96. *To write on Paper with Letters of Gold.*

Put some gum arabic into common writing ink, and write with it in the usual way. When the writing is dry, breathe on it; the warmth and moisture softens the gum, and will cause it to fasten on the gold leaf, which may be laid on in the usual way, and the superfluous part brushed off. Or instead of this, any japanners size may be used.

97. *Gilding by Amalgamation*

Is by previously forming the gold into a paste, or amalgam, with mercury.

In order to obtain an amalgam of gold and mercury, the gold is first to be reduced into thin plates or grains, which are heated red-hot, and thrown into mercury previously heated, till it begins to smoke. Upon stirring the mercury with an iron rod, the gold totally disappears. The proportion of mercury to gold, is generally as six or eight to one.

98. *An improved Process for Gilding Iron or Steel.*

This process, which is less known among artists than it deserves to be, may prove useful to those who have occasion to gild iron or steel. The first part of the process consists in pouring over a solution of gold in nitro-muriatic acid (aqua regia) about twice as much ether, which must be done with caution, and in a large vessel. These liquids must then be shaken together; as soon as the mixture is at rest, the ether will be seen to separate itself from the nitro-muriatic acid, and to float on the surface. The nitro-muriatic acid becomes more transparent, and the ether darker than they were before; the reason of which is, that the ether has taken the gold from the acid. The whole mixture is then to be poured into a glass funnel, the lower aperture of which is small; but this aperture must not be opened till the fluids have completely separated themselves from each other. It is then to be opened; by which means the liquid which has taken the lowest place by its greater gravity, viz. the nitro-muriatic acid, will run off; after which, the aperture is to be shut, and the funnel will then be found to contain nothing but ether mixed

with the gold; which is to be put into well closed bottles, and preserved for use. In order to gild iron or steel, the metal must first be well polished with the finest emery, or rather with the finest crocus martis, or colcothar of vitriol, and common brandy. The auriferous ether is then to be applied with a small brush; the ether soon evaporates, and the gold remains on the surface of the metal. The metal may then be put into the fire, and afterwards polished. By means of this auriferous ether, all kinds of figures may be delineated on iron, by employing a pen, or fine brush. It is in this manner, we believe, that the Sohlinger sabre blades are gilded.

Instead of ether, the essential oils may be used, such as oil of turpentine, or oil of lavender, which will also take gold from its solution.

99. *Cold Gilding of Silver.*

Dissolve gold in the nitro-muriatic acid, and dip some linen rags in the solution; then burn them, and carefully preserve the ashes, which will be very black, and heavier than common. When any thing is to be gilded, it must be previously well burnished; a piece of cork is then to be dipped, first into a solution of salt in water, and afterwards into the black powder; and the piece, after being rubbed with it, must be burnished. This powder is frequently used for gilding delicate articles of silver.

100. *To silver Copper or Brass.*

Cleanse the metal with aqua fortis, by washing it lightly, and then throwing it into water; or by scouring it with salt and tartar with a wire brush. Dissolve some silver in aqua fortis, and put pieces of copper into the solution; this will throw down the silver in a state of a metallic powder. Take fifteen or twenty grains of this silver powder, and mix with it two drachms of tartar, the same quantity of common salt, and half a drachm of alum; rub the articles with this composition till they are perfectly white, then brush it off, and polish them with leather.

101. *To silver the Dial-plates of Clocks, Scales of Barometers, &c.*

Take half an ounce of silver lace, add thereto an ounce of double refined aqua fortis, put them into an earthern pot, and place them over a gentle fire till all is dissolved, which will happen in about five minutes; then take them off, and mix it in a pint of clear water, after which, pour it into another clean vessel, to free it from grit or sediment; then add a

spoonful of common salt, and the acid, which has now a green tinge, will immediately let go the silver particles, which form themselves into a white curd; pour off the acid, and mix the curd with two ounces of salt of tartar, half an ounce of whiting, and a large spoonful of salt, more or less, according as you find it for strength. Mix it well up together, and it is ready for use.

Having well cleared the brass from scratches, rub it over with a piece of old hat and rotten-stone, to clear it from all greasiness, and then rub it with salt and water with your hand: take a little of the beforementioned composition on your finger, and rub it over where the salt has touched, and it will adhere to the brass, and completely silver it. After which, wash it well with water, to take off what aqua fortis may remain in the composition; when dry, rub it with clean rags, and give it one or two coats of varnish, prepared according to the directions given under the article *varnishes*.

This silvering is not durable, but may be improved by heating the article, and repeating the operation till the covering seems sufficiently thick.

102. *To silver Looking Glasses.*

In order to go completely forward, you must be prepared with the following articles, viz.—

First, A square marble slab, or smooth stone, well polished, and ground exceedingly true, the larger the better, with a frame round it, or a groove cut in its edges, to keep the superfluous mercury from running off. Secondly, Lead weights covered with cloth, to keep them from scratching the glass, from one pound weight to twelve pounds each, according to the size of the glass which is laid down. Thirdly, Rolls of tinfoil Fourthly, Mercury or quick-silver, with which you must be well provided; then proceed as follows:—

Cut the tinfoil a little larger than the glass every way, and lay it flat upon the stone, and with a straight piece of hard wood, about three inches long, stroke it every way, that there be no creases or wrinkles in it, then drop a little mercury upon it, and with a piece of cotton, wool, or hair's foot, spread it all over the foil, so that every part may be touched with the mercury. Then keeping the marble slab nearly level with the horizon, pour on the mercury all over the foil, cover it with a fine paper, and lay two weights very near its lowest end or side, to keep the glass steady, while you draw the paper from between the silvered foil and the glass, which must be laid upon the paper. As you draw the paper, you must take care that no air bubbles be left, for they will always appear if left in at the first; you must likewise be sure to make the glass as clean as possible on the side intended to be

silvered, and have the paper also quite clean, otherwise, when you have drawn the paper from under it, dull white streaks will appear, which are very disagreeable.

After the paper is drawn out, place as many weights upon the glass as you conveniently can, in order to press out the superfluous mercury, and make the foil adhere to the glass. When it has lain six or seven hours in this situation, raise the stone about two or three inches at its highest end, that as much of the mercury may run off as possible; let it remain two days before you venture to take it up; but before you take the weights off, gently brush the edges of the glass, that no mercury may adhere to them; then take it up, and turn it directly over, with its face side downward, but raise it by degrees, that the mercury may not drip off too suddenly; for if, when taken up, it is immediately set perpendicular, air will get in between the foil and the glass at the top, as the mercury descends to the bottom; by which means, if you be not exceedingly careful, your labour will be lost.

103. *To Silver Glass Globes.*

Take half an ounce of clean lead, and melt it with an equal weight of pure tin; then immediately add half an ounce of bismuth, and carefully skim off the dross; remove the mixture from the fire, and before it grows cold, add five ounces of mercury, and stir the whole well together; then put the fluid amalgam into a clean glass, and it is fit for use.

When this amalgam is used for foiling or silvering, let it first be strained through a linen rag; then gently pour some ounces thereof into the globe intended to be foiled; the mixture should be poured into the globe, by means of a glass or paper funnel, reaching almost to the bottom of the globe, to prevent its splashing to the sides; the globe should then be dexterously inclined every way, though very slowly, in order to fasten the silvering: when this is once done, let the globe rest some hours; repeat the operation, till at length the fluid mass is spread even, and fixed over the whole internal surface; as it may be known to be, by viewing the globe against the light; the superfluous amalgam may then be poured out, and the outside of the globe cleared.

104. *To whiten Brass or Copper by boiling.*

Put the brass or copper into a pipkin with some white tartar, alum, and grain tin, and boil them together. The articles will soon become covered with a coating of tin, which, when well polished, will look like silver. It is in this manner that pins, and many sorts of buttons, are whitened.

105. *To make an enamel as white as milk.*

1. To six pounds weight of the matter just described put forty-eight grains of magnesia, prepared as follows.

2. Put in an iron spoon, to the reverberating fire, the bits of magnesia, rough as it comes from the mine. When it is whitened, pour good vinegar over it, then break it small, and wash it several times with warm water. Dry, pulverise, and sift it, then preserve it in a covered pot for use.

3. This magnesia, and primary enamel matter, you put, in the above prescribed proportion, in a crucible, on a glass-melting fire, then throw the whole contents into clear water; dry it, melt it again, as before, and throw it in water again, and so on. This operation repeat three times. Being thus well purified, if you find it not quite white enough, add a little more magnesia, and begin the same process as before. Then take it off the fire, and make it into small round cakes. Such is the method of preparing the enamel to paint with on gold, and other metals.

106. *To make green enamel.*

1. Melt and purge, by the glass-melting fire, and in a varnished crown-glass pot, four pounds of the primary enamel matter. Leave it there twelve hours; after which throw it in water, dry it, and put it again in the same fire, for the same time, to cleanse it well.

2. Grind into a very subtile powder, some of the aforesaid scories of copper, and some scories of iron. Mix these powders together, *viz.* two ounces of the former, and 48 grains only of the latter; which, being divided into three different parcels, project, at three distinct times, on the enamel matter in fusion, stirring well with an iron hook at the time of each projection, that the colour may better incorporate; and in twelve hours afterwards you will find a very fine green enamel.

107. *To make a black shining enamel.*

Take of our primary enamel matter in powder, four pounds; red tartar, four ounces; and of our prepared magnesia, in subtile powder, two. Put all this into a varnished pipkin, so large, that all these powders together shall not come higher than the third part of the vessel, this matter, when melted, swells very much. When in perfect fusion, throw it into water; take it out to dry, then put it again in the pot, and purify it as before. Do so till you find it sufficiently purified; then take the pot off the fire, and the matter out of the pot.

108. *To make an enamel purple colour.*

Reduce into subtile powder, and mix well together, six pounds of our primary and general enamel matter; three ounces of prepared magnesia, and six of scories of copper, prepared as before mentioned. Melt and purify all this in a varnished pipkin, by placing it in a melting-glass furnace.—When in good fusion, throw this matter in water; dry it, and put it again in the same pot to purify it a new by the same process. If you find your colour to your liking, take the pot off from the fire, and keep your enamel for use.

109. *To make red enamel, of a beautiful ruby hue.*

Put twenty ounces of the above fusible magnesia, to one pound of the crystaline matter in good fusion. Purify the whole well, and try the colour.

Note. According to the proportion of fusible magnesia you put in this composition, you raise or lower the hue of your enamel. And, if carried to the degree of rubies, it will prove bright and beautiful.

110. *To jasper glass globes.*

Wet the inside of a glass globe with common water; then throw in some powder blue, or ultramarine, or else some of the finest smalt, and stir well the globe, that these powders may stick every where. Then dilute some other colours with nut oil, keeping each particular colour by itself. With the downy end of a quill, put some of these colours, one after another, in the globe, touching it every way with them. Put some flour after that in the globe, and shake it so as to make it go all over, and then the work is finished.

111. *To give globes a silver colour.*

To four ounces of pewter, in fusion, add two of quicksilver. Stir all well with a wooden spatula; and when the whole is well incorporated, pour some of this compound into your globes, which must previously have been warmed before the fire. Turn them in all manner of directions, that the composition may fix itself better and more equally in all their capacity. Chop some tinsel very fine, and throw it in the globes when the pewter begins to cool, these little laminas will stick themselves to it, and produce the finest effect imaginable.

112. *A good method of tinning glass globes.*

Melt together one ounce of tin glass, and half that quanti-

ty of pewter and of lead. When both are thus in fusion, throw in some mercury, and the whole into a pan full of water. Pour the water off by inclination, and dry this matter; then pass it through a piece of linen and roll it in a globe that is very dry in the inside.

113. *To make transparent frames.*

Boil for a quarter of an hour only, nut oil, six ounces; white wax, four; rosin, as much; and Venice turpentine, two. When lukewarm, lay it on with a soft brush.

114. *To make lake.*

Take three parts of an ounce of Brasil wood; a pint of clear water; one drachm and a half of roch allum; eighteen grains of salt of tartar; the bulk of two filberts of mineral crystal; three quarters of a pound of the whitest sound, or cuttle-fish bones, rasped. Put all together in a saucepan to boil, till reduced to one third. Strain it three times through a coarse cloth. To make a finer sort, strain it four times.—Then set in the sun under cover to dry. That which dries the soonest is the finest.

115. *To make a liquid lake.*

Pound some cochineal and allum together; then boil them with a quantity of lemon-peels, cut very small. And when it is come to the right colour you want, pass it through a cloth.

116. *A blue, very like ultramarine.*

Grind some indigo on porphyry with turpentine oil. Put it afterwards in a glazed pipkin, and lute it well. Let it thus lay for the space of six weeks. The longer you leave it, the more blue it will be.

117. *How to make a fine flesh colour.*

The mere addition of a little black to the above composition will make the finest colour for complexions, or flesh-colour, and may justly be deemed a ninth article in the process which is to be observed in its fabrication.

118. *A good way to make carmine.*

Make a little bag, tied very close, of fine Venetian lake.—Put it in a little varnished pipkin, with rain-water and cream of tartar, and boil it to a sirup. Thus you will have a fine carmine colour.

119. *The whole process of making ultramarine.*

1. Make some of the brownest *lapis* red hot in a crucible, then throw it into vinegar. Repeat this three times. When calcined, pound it in a mortar, and sift it. Then grind it on porphyry, with a mixture of lintseed oil and spirit of wine, in equal quantities, and previously digested together in a matrass, and often shaken to prepare them for this use. When you shall have subtalized your *lapis* powder, then incorporate it with the following cement.

2. Lintseed oil, two ounces; Venice turpentine, three; mastich, half a one; *assa fætida*, two; black rosin, as much; wax, half an ounce; yellow rosin, three. Boil all in a glazed pipkin, for quarter of an hour; then run it through a cloth into clear water. Take it out of that water; and, taking of this, and of the grinded *lapis*, equal quantities, incorporate them in a glazed pan, and pour some clean warm water over, and let it rest for a quarter of an hour. Stir this water with a wooden spatula; and in another quarter of an hour you will see the water all azured. Decant, gently, that water into another glazed pan. Pour new warm water on the grounds, and proceed as before, continuing to stir and beat it well; then decant again this new azured water with the former. Repeat doing so, till the water is no more tainted with any azurine particles. When done, set your azured waters in evaporation, and there will remain at the bottom a very fine Azure of Ultramarine, *viz.* four ounces of it for every pound of composition. Of the remainder you may make what is called *cender blue*.

120. *Observations on the above process.*

1. Ultramarine might be drawn from the pastil, by working it with the hands instead of pestles. But, as it fatigues a great deal more the articulations by that sort of working, than by the other, there is room to think, that by this mode of proceeding, each single operation might be attended with some imperfection; which is the reason why the pestles are preferable.

2. Some people make their *lapis* red hot on bare coals, then steep it in distilled vinegar, repeating this several times till it becomes fryable.

3. But it is much preferable to make it red hot in a crucible; because, should the fire make it split, the bits will remain in the crucible. Now it need not be wondered at if it does, particularly when calcinations are often repeated.

4. The *lapis*, which is of a fine blue, and striped with gold or silver, is the best to make ultramarine of.

5. The *lapis* is also reckoned to be of good quality, when

it preserves its fine colour, even after it has been made red-hot in blasting charcoals.

121. *To make the Bistre for the wash.*

1. Grind, on marble, with child's water, some chimney-soot. Mullar it as fine as possible. When done, put it in a wide-mouthed bottle, which fill up with clear water; and then stir and mix all well with a wooden spatula. Let the coarsest parts settle to the bottom of the vessel. Decant out the liquor gently into another vessel. What remains in the bottom is the coarest bistre.

2. Proceed the same with respect to the second bottle, and after having left this to settle for three or four days, instead of half an hour, decant it into a third. This gives you the finest bistre.

3. In the manipulation of all the colours which are intended to serve in drawing for wash, whenever you will not have them rise thick above the surface of the paper, which would undoubtedly look very bad; for the neatness required in a draught, forbids the use of any coarse colour.

122. *The secret for a fine red for the wash.*

1. Make a subtile powder with cochineal. Put it in a vessel, and pour rose-water over it as will exceed above it by two fingers.

2. Dilute calcined and pulverised alum, while it is quite warm, into plantain water, and mix some of the liquor in which you have dissolved the cochineal.

3. This process will give you a very fine red, much preferable for the wash, to that which is made with vermilion, because this last has too much consistence, and besides tarnishes too soon, on account of the mercury which enters into its composition.

123. *A secret to make carmine at a small expense.*

Break and bruise in a bell-metal mortar, half a pound of gold colour Fernambourg Brasil. Put this to infuse with distilled vinegar, in a glazed pipkin, in which boil it for the space of a quarter of an hour. Strain the liquor through a new strong cloth; then set it again on the fire to boil. When it boils, pour on it white wine vinegar, impregnated with Roman alum. Stir well with a wooden spatula, and the froth that will arise is the carmine. Skim it carefully in a glass vessel, and set it to dry.

124. *The proper varnish to be laid on glass after painting.*

Boil oil of nuts, some litharge, lead filings, and white copperas calcined. When done and cold, lay it all over the colours which you put on the glass.

125. *How to paint on glass without fire.*

Take gum arabic and dissolve it in water with common salt, bottle and keep it. With this liquor, if you grind the colours you intend to paint with, they will fix and eat in the glass. Should you find they do not enough, increase only the dose of salt.

126. *A secret to render old pictures as fine as new.*

Boil in a new pipkin, for the space of quarter of an hour, one quarter of a pound of gray or Bril-ash, and a little Genoa soap. Let it cool, to a lukewarm, and wash your picture with it, then wipe it. Pass some olive oil on it, and then wipe it off again. This will make it just as fine as new.

127. *An Oil to prevent Pictures from blackening. It may serve also to make cloth to carry in the pocket, against wet weather.*

Put some nut, or lintseed oil, in a phial, and set it in the sun to purify it. When it has deposited its dregs at the bottom, decant it gently into another clean phial, and set it again in the sun as before. Continue so doing, till it drops no more *fæces* at all. And with that oil, you make the above composition.

128. *A Wash to clean Pictures.*

Make a lye with clear water and wood ashes; in this dip a sponge, and rub the picture over, and it will cleanse it perfectly. The same may be done with chamber-lye only; or otherwise, with white wine, and it will have the same effect.

129. *A very curious and simple way of preventing flies from sitting on pictures, or any other furniture, and making their dung there.*

Let a large bunch of leeks soak for five or six days in a pail-ful of water, and wash your picture, or any other piece of furniture, with it. The flies will never come near any thing so washed. This secret is very important and well experienced.

130. *To make Indigo.*

Put some *isatis*, otherwise woad, or glastum, with slacked lime, to boil together in water. There will rise a scum, which being taken off, and mixed with a little starch, makes the indigo.

131. *To make a Yellow.*

What the *luteola* dyes yellow, becomes green by the woad, or *glastum*. Whence we may justly conclude, that green is not a simple colour, but a mixture of blue and yellow; as the yellow itself is a compound of red and white.

132. *A white for painters, which may be preserved for ever.*

Put into a large pan three quarts of lintseed oil, with an equal quantity of brandy, and four of the best double distilled vinegar; three dozen of eggs, new laid and whole; three or four pounds of mutton suet, chopped small. Cover all with a lead plate, and lute it well. Lay this pan in the cellar for three weeks, then take skilfully the white off, then dry it. The dose of the composition for use is six ounces of that white to every one of bismuth.

133. *Another white for ladies paint.*

To four parts of hog's lard add one of a kid. Melt them together, then wash them. Re-melt and wash them again. Then add four ounces of ammoniac salt, and as much of sulphur, in subtile powder. This white will keep a long time.

134. *A good azure.*

Take two ounces of quicksilver; sulphur and ammoniac salt, of each one ounce. Grind all together, and put it to digest in a matrass over a slow heat. Increase the fire a little; and, when you see an azured fume arising, take the matrass off the fire. When cool, you will find in the matrass as beautiful an azure as the very ultramarine itself.

135. *A fine azure.*

Make an incorporation of three ounces of verdigrease, and of an equal quantity of ammoniac salt, which dilute with tartar water, so as to make a thick paste of it. Put this composition into a glass, and let it rest for a few days, and you will have a fine azure.

136. *A lively Isabel Colour.*

To make a lively Isabel colour, you must to a quantity of white, add one half of yellow, and two-thirds of red and yellow.

137. *For a pale filbert colour.*

1. Take burnt umber, a little yellow, very little white, and still less red.
2. This is made darker, by adding a quantity of burnt umber, as much yellow, a little white, and as much red.

138. *For the gold colour.*

To much yellow, join a little more red; and this mixture will give you a very fine bright gold colour.

139. *For the flesh colour.*

To imitate well the complexion, or flesh colour, you mix a little white and yellow together, then add a little more red than yellow.

140. *The straw colour.*

Much yellow; very little white; as little red, and a great deal of gum.

141. *A fine brown.*

1. Burnt umber; much black chalk; a little black, and a little red; will make a fine brown, when well incorporated together.
2. The same is made paler, by decreasing the quantity of black chalk, and no black at all in the above composition.

142. *To make a fine musk colour.*

Take burnt umber; very little black chalk; little red and a little white. These ingredients well mixed will produce as fine a musk colour as ever was.

143. *To make a frangipane colour.*

1. This is made with a little umber; twice as much red, and three times as much yellow.
2. The paler hue of it is obtained by adding only some white, and making the quantity of red equal to that of yellow.

144. *An olive colour.*

To make the olive colour, take umber, not burnt; a little yellow; and the quarter part of it of red and yellow.

145. *How to make skins and gloves take these dyes.*

Grind the colours you have pitched upon with perfumed oil of jessamine, or orange flowers. Then range the grinded colour on a corner of the marble stone. Grind of gum-adragant, an equal quantity as that of the colours, soaking it all the while with orange flower water. Then grind both the gum and the colour together, in order to incorporate them well. Put all into a pan, and pour a discretionable quantity of water over it, to dilute sufficiently your paste. Then with a brush, rub your gloves or skins over with this tinged liquor, and hang them in the air to dry. When dry, rub them with a stick. Give them again, with the same brush another similar coat of the same dye, and hang them again to dry. When dry for this second time, you may dress them, the colour is sufficiently fixed, and there is no fear of its ever coming off.

146. *To varnish a chimney.*

Blacken it first with black and size. When this coat is dry, lay another of white lead over it, diluted in mere sized water. This being dry also, have verdigrease diluted and grinded with oil of nuts and a coarse varnish, and pass another coat of this over the white.

147. *A varnish which suits all sorts of prints and pictures; stands water, and makes the work appear as shining as glass.*

Dilute one quarter of a pound of Venice turpentine, with a gill, or thereabouts, of spirit of wine. If too thick, add a little more of this last; if not enough, a little of the former, so that you bring it to have no more thickness than the apparent one of milk. Lay one coat of this on the right side of the print, and when dry, it will shine like glass. If it be not to your liking, you need only lay another coat on it.

148. *To make appear in gold the figures of a print.*

1. After having laid on both sides of the print, one coat of the varnish described in the above *Art.* 147, in order to make it transparent, let it dry a little while. Then, before it is quite so, lay some gold in leaves on the wrong side of

the print, pressing gently on it with the cotton you hold in your hand. By these means all the parts, whereon you lay these gold leaves, will appear like true massive gold on the right side.

2. Now, when this is all thoroughly dry, lay on the right side of it, one coat of the varnish described in the preceeding *Art.* 147, it will then be as good as any crown-glass. You may also put a paste board behind the print, to support it the better in its frame.

149. *A curious secret to make a print imitate the painting on glass.*

Chuse a crown-glass of the size of your print; and lay on it two coats of the following varnish:

1. Put on the fire, in a glazed pipkin, and let boil for the space of one hour, Venice turpentine, four ounces; spirit of the same, and of wine, equal parts, one ounce and a half of each; mastich in tears, two drachms.

2. After it has boiled the prescribed time, let it cool, and then lay the first coat on the glass; this being dry, lay another; and, as soon as this is nearly dry, then lay on it, as neatly as possible, the print, previously prepared as follows.

3. Have a glazed vessel so broad at bottom as to admit of the print flat with all ease in its full size. Let this vessel be also as wide at top as it is at bottom, that you may get the print in and out of it on its flat, without bending it in the least. Pour *aquafortis* in this pan or veesel, enough to cover all the bottom, then lay the engraved side of your print on that *aquafortis*. Take it out, and wipe the *aquafortis* off gently with soft rags, then steep it two or three times in three different clean fresh waters, and wipe it each time in the same manner.

4. This being done, lay the right side on the before-mentioned glass, before the second coat of varnish be quite dry, and while it is still moist enough for the print to stick upon it uniformly, equally, and smoothly, without making any wrinkles or bladders. When it is perfectly dried in that situation, wet your finger in common water, and moistening the print on the back part in all the white places, which have received no impression from the engraving of the plate, rub it all off. By these means, there will remain nothing but fairly the printed parts. On them you may paint in oil with a brush, and the most bright and live colours; and you will have pictures, on which neither dust nor any thing else will be able to cause any damage. To do this, there is no need of knowing, either how to paint or draw.

150. *To prepare a transparent paper to chalk with.*

In order to obtain the art of chalking neatly, and not to go out of the fine turns and outlines of a drawing, beginners should first know how to prepare a transparent paper, which, as it lets them see the minutest parts of the strokes as through a glass, gives them of course an opportunity of acquiring by practice, a correctness in the expression of all the turns of drawing. This preparation is as follows:

1. Have, one or several, sheets of fine and very thin paper, and rub them over with oil, or spirit, of turpentine, mixed in double the quantity of oil of nuts. To cause the paper to imbibe that mixture, steep a sponge or feather in it, which pass on both sides of the paper, and then let it dry.

2. When you want to use it, lay it on a print. Then, with a brush, a pencil, or a pen, pass over all the strokes, lines and turns, of the design laid under. You may even thus learn to shade with neatness, if you wash that same design, while fixed on the original print, with India ink.

By practising often you may learn to draw very neatly, and even with boldness. This method will certainly prove very useful, and entertaining, for those who have not the patience to learn by the common method, which seems too tedious to some, and generally disgusts beginners.

151. *How to draw on glass.*

Grind lamp-black with gum-water and some common salt. With a pen or hair pencil, draw your design on the glass, and afterwards shade and paint it with any of the following compositions.

152. *A colour for grounds on glass.*

1. Take iron filings and Dutch yellow beads, equal parts. If you want to have a little red cast, add a little copper filings. With a steel mullar grind all these together on a thick and strong copper plate, or on porphyry. Then add a little gum-arabic, borax, common salt and clear water. Mix these a little fluid, and put the composition in a phial for use.

2. When you come to make use of it, you have nothing to do but with a hair pencil lay it quite flat on the design you had drawn the day before; and having left this to dry also for another day, with the quill of a turkey, the nib of which shall not be split, you heighten the lights in the same manner as you do with crayons on blue paper. Whenever you put more coats of the above composition one upon another, the shade, you must be sensible, will naturally be stronger. And when this is finished, you lay your colours for garments and complexions as follows.

153. *Preparation of lake, for glass.*

Grind the lake with a water impregnated with gum and salt; and then make use of it with the brush.—The shading is operated by laying a double, treble, or more coats of the colour, where you want it darker. And so it is of all the following compositions of colours.

154. *Preparation of the blue purple, for glass.*

Make a compound of lake and indigo, grinded together with gum and salt water; and use it as it as directed in the preceding article.

155. *Preparation of the green for glass.*

Indigo mixed with a proportionable quantity of gamboge, and grinded together as above, will answer the intended purpose.

156. *Preparation of the yellow for the same.*

Gamboge grinded with salt water only.

156. *Preparation of the white.*

You have only to heighten much the white parts with a pen.

157. *The preparation of verdigrease.*

Grind the verdigrease with vinegar, and put it in a piece of brown bread dough. Bake it as you would bread; and when done, cut it open and take it out. You will then have a very fine verdigrease, fit to work with, either in oil or water, as you like.

158. *A fine liquid Green.*

Mix well together, one pound of Montpelier verdigrease, and half a pound of white tartar from the same place. Put this a soaking for twelve hours in two quarts of the strongest vinegar, then reduce it by boiling to one half. Let it rest for two days, and filter it afterwards in a bottle, wherein you keep it for use.

159. *To make a fine Vermilion.*

Make a mixture of cochineal powder and burnt alum.—Stifle it quite hot in rose or plantain water. It will give you the finest vermilion in the world.

160. *A secret to draw without either ink or pencil.*

Rub a sheet of paper with tripoly. Then, with any blunt point, form your drawing on it. Whatever you trace will be visible.

161. *To make an imitation of enamel on tin, for chimney branches,* &c.

Get a sheet of block-tin very clean, and cut it in the form, shape, and figure you chuse to make your flowers and other things. Grind what colours you propose to make use of, with clean water, and each separately, then let them dry. When you want to employ them, dilute them, each apart, with liquid varnish, and lay them on with the brush. Set the work in the open air for fear the colours should run, and when they are a little thickened and consolidated, finish drying them before a gentle fire.

162. *A valuable secret to make exceeding good Crayons, as hard as red chalk, discovered by Prince* Rupert, *brother to Prince* Palatin.

Grind on the stone some tobacco-pipe clay, with common water, so as to make a paste of it. Then take separately each colour, and grind them, when dry, on the stone, so fine as to sift them through a silk sieve. Mix, of each of the colours, with your first white paste, as much as will make it of a higher or paler hue, and embody the whole with a little common honey and gum-arabic water.

Note. You must be attentive to make crayons of various degrees of hues in each colour, for the *chiaros* and *oscuros*, or lights and shades. Then roll each crayon between two boards very clean, and set them to dry on paper for two days in the shade. To complete their drying, lay them in the sun; and then you may use them with satisfaction.

163. *A fine red water, for Miniature Painting.*

1. Put in a new glazed pipkin one ounce of *Fernamburg Brazil* wood, finely rasped. Pour three pints of spring water on it, with six drachms of fine white isinglass chopped very small. Place the pot on warm ashes, for three days, during which you are to keep up the same degree of heat.

2. When the isinglass is melted, and two ounces of kermes in grain, one of alum, and three drachms of borax, well pounded. Boil this gently to the reduction of one half; then strain

the liquor through a cloth, bottle and stop it well, and set it in the sun for a week before using.

Note. This water may very properly be used as a wash to give an agreeable bloom to pale faces.

164. *Directions for the mixture of Colours.*

1. The pale yellow for the lights, is made with white massicot. The *chiaro oscuro*, with the massicot and umber. The dark shade with umber alone.

2. The orange colour is made with black lead for the lights, shade with the lake.

3. The lake is used very clear for the lights, in draperies, and thicker for the shades.

4. The purple is made with blue, white, and lake, for the lights; blue and lake only for the clear shades, and indigo and blue for the darker ones.

5. The pale blue is used for the lights, and for the clear shades a little thicker; but for the darker shades, mix the indigo and blue together.

6. The gold like yellow is made with yellow massicot for the lights; and the clear shades with a mixture of black lead and massicot; the darker shade with lake, yellow ochre, and very little black lead; and the darker of all, with Cologn earth and lake.

7. The green is of two sorts. The first made with massicot and blue, or blue and white; and for the shades, make the blue predominate in the mixture. The other is made with calcined green; and French berries juice, mixed and calcined green; and you may form their shades by addition of indigo.

8. For trees you mix green and umber together.

9. The grounds are made in the same way; wherever there is any green, take calcined green, with French berries juice.

10. For the distances, mix green and blue together; and mountains are always made with blue.

11. The skies are likewise made with blue, but you must add a little yellow to them, when it comes near the mountains; to make the transition between that and the blue, mix a little lake and blue together to soften it.

12. Clouds are made with purple; if they be obscure, you must mix lake and indigo together.

13. Stones are made with white and yellow mixed together, and their shades with black.

165. *To take off instantly a copy from a print, or a picture.*

Make a water of soap and alum, with which wet a cloth or a paper; lay either on a print or picture, and pass it once

under the rolling-press; then going round the other side to take it up, you will have a very fine copy of whatever you shall have laid it upon.

166. *To make the Spanish ladies* rouge.

Vermilion, carefully laid on a sheet of paper, from which, by means of wetting the tip of your finger with your spittle, then take it off, at will, and rub your cheeks, lips, &c. The method of making it is as follows.

1. Take good scarlet flocks and spirit of wine, or in their stead, lemon-juice. Boil the whole in an earthen pot, well glazed and well stopped, till the spirit of wine, or lemon-juice, has charged itself with all the colour of the scarlet flocks. Strain this dye through a cloth, and wring it hard, to express well all the colour out. Boil it afterwards with a little arabic water, till the colour becomes very deep.

2. On half a pound of scarlet flocks you must put four ounces of spirit of wine, and a sufficient quantity of water, to soak well the flocks. Then in the colour you extract from it, put the bulk of a filbert of gum arabic, and boil the whole in a silver porringer. When this is ready, as we said before, proceed as follows.

3. Steep some cotton in the colour, and wet some sheets of paper with it; then let them dry in the shade. Repeat this wetting, drying of the same sheets over again, many times, till you find they are charged with *rouge* to your satisfaction.

167. *A fine lake, made with shell-lac.*

1. Boil and skim well, sixteen pounds of chamber-lye; then put in one pound of fine shell-lac, with 5 ounces of roch alum, in powder. Boil altogether, till you see the chamber-lye is well charged with the colour, which you may easily know, by steeping a bit of white rag in it; then take it out again, to see whether or not the colour please you; and if it do not, let it boil longer, repeating the same trial, till you are perfectly satisfied.

2. Throw now the liquor in a flannel bag, and without suffering what runs into the pan under to settle, repour it into the bag so many times, till the liquor runs at last quite clear, and not tinged. Then with a wooden spatula, take off the lake, which is in form of curd, form it into small cakes, or balls, and dry them in a shade on new tiles; then keep them for use.

168. *An Azure as fine as, and which looks similar to, Ultramarine.*

Grind well together into powder three ounces of ammo-

niac salt, and six of verdigrease. Then wet it in continuing to grind it with oil of tartar, till you have made it pretty fluid. Put this into a glass matrass, and bury it five days in hot dung. At the end of that term you will find your composition turned into a fine azure.

169. *A very fine method for Marbling Paper.*

The paper must first be prepared, by wetting the paper with a sponge dipped in roch-alum water, then letting it dry. When the sheets have been thus prepared, have a pan full of water, and with a large and long-handled painting-brush, take of one colour, and shake it in the water; take of another and do the same, and so on till you have taken of all the colours you intend to have on your paper. Each of these colours fall to the bottom of the water; but take with a similar brush as the first, a mixture of bullock's gall, and of dissolution of soap in water, then shake on the water, and all over the surface, and you will soon see all the colours rising up again and swimming on the top of the water each separately as you first put them. Then lay the sheet of paper on it, give it a turn on one side or the other, as you like, and take it up again; wash and set it to dry, then burnish it, and it is done.

170. *To gild on Glasses, Earthen, or China Wares.*

Take a glass, or china cup, wet it, and lay your gold where and how you like, then let it dry. Dissolve some borax in water, and of this liquor lay a coat on your gold. Set it in the fire till your glass powder in melting makes a varnish on the gilded parts, which will then appear very beautiful.

171. *To write, or paint, in silver, especially with a pencil.*

Pound well, in a bell-metal mortar, some tin glass; then grind, and dilute it, on porphyry, with common water. Let it settle, and throw off the water, which will be black and dirty. Reiterate this lotion so many times, till the water remains clear. Then dilute it in gum-water, and either write or paint with it. It will appear very handsome, and no ways inferior to the finest virgin silver.

172. *To Silver the Convex side of Meniscus Glasses for Mirrors.*

Take an earthen plate, on which pour some prepared plaster of Paris, mixed with water, of a proper consistence; then immediately, before it grows too stiff, lay the meniscus with its convex side downward, in the middle of the plate, and press it until it lies quite close to the plaster; in which situ-

ation let it remain until the plaster becomes quite dry; after which, work a groove with your finger, round the outside of the meniscus, in order to let the superfluous mercury rest upon it; then cut the tinfoil to a proper size, and press it with the meniscus into the plaster mould, in order to make it lie close; after which, cover it with the mercury, and, without a paper (as directed for silvering plain mirrors,) slide it over the silvered foil; then place a weight on it, and let it stand two or three days, raising it by degrees, that the mercury may drip off gradually.

After this method common window glass, &c. may be silvered.

173. *Tinning of Iron.*

When iron plates are to be tinned, they are first scoured, and then put into what is called a pickle, which is oil of vitriol diluted with water; this dissolves the rust or oxyd that was left after scouring, and renders the surface perfectly clean. They are then again washed and scoured. They are now dipped into a vessel full of melted tin, the surface of which is covered with fat or oil, to defend it from the action of the air. By this means, the iron coming into contact with the melted tin in a perfectly metallic state, it comes out completely coated.

When a small quantity of iron only is to be tinned, it is heated, and the tin rubbed on with a piece of cloth, or some tow, having first sprinkled the iron with some powdered resin, the use of which is to reduce the tin that may be oxydated. Any inflammable substance, as oil for instance, will have in some degree the same effect, which is owing to their attraction for oxygen.

174. *Tinning of Copper.*

Sheets of copper may be tinned in the same manner as iron. Copper boilers, saucepans, and other kitchen utensils, are tinned after they are made. They are first scoured, then made hot, and the tin rubbed on as before with resin. Nothing ought to be used for this purpose but pure grain tin; but lead is frequently mixed with the tin, both to adulterate its quality, and make it lay on more easily; but it is a very pernicious practice, and ought to be severely reprobated.

175. *SOLDERING.*

Soldering is the art of joining two pieces of metal together by heating them, with a thin piece of plate or metal interposed between them. Thus tin is a solder for lead: brass, gold, or silver, are solders for iron, &c.

176. *To make Silver Solder.*

Melt fine silver two parts, brass one part; do not keep them long in fusion, lest the brass fly off in fumes.

177. *A Solder for Gold.*

Melt copper one part, fine silver one part, and gold two parts; add a little borax when it is just melted, then pour it out immediately.

178. *The method of Soldering Gold or Silver.*

After the solder is cast into an ingot, it would be more ready for use if you were to draw it into small wire, or flat it between two rollers; after that cut it into little bits, then join your work together with fine soft iron wire, and with a camel's-hair pencil dipt in borax finely powdered, and well moistened with water, touch the joint intended to be soldered; placing a little solder upon the joint, apply it upon a large piece of charcoal, and, with a blow-pipe and lamp, blow upon it through the flame until it melts the solder, and it is done.

179. *A Solder for Lead.*

Two parts lead and one part tin: its goodness is tried by melting it, and pouring the bigness of a crown piece upon the table; if it be good, there will arise little bright stars in it. Apply resin when you use this solder.

180. *A Solder for Tin.*

Take four parts of pewter, one of tin, and one of bismuth; melt them together, and run them into narraw thin lengths.

181. *A Solder for Iron.*

Nothing here is necessary, but good tough brass, with borax applied, mixed with water to the consistence of paste.

182. *MOULDING AND CASTING.*

The art of taking casts or impressions from pieces of sculpture, medals, &c. is of very great importance in the fine arts. In order to procure a copy or cast from any figure, bust, medal, &c. it is necessary to obtain a mould, by pressing upon the thing to be moulded or copied, some substance which, when soft, is capable of being forced into all the cavities or hollows of the sculpture. When this mould is dry and hard, some substance is poured into it, which will fill all

the cavities of the mould, and represent the form of the original from which the mould was taken.

The particular manner of moulding depends upon the form of the subject to be worked upon. When there are no projecting parts but such as form a right or a greater angle with the principal surface of the body, nothing more is required than to cover it over with the substance of which the mould is to be formed, taking care to press it well into all the cavities of the original, and to take it off clean, and without bending.

The substances used for moulding are various, according to the nature and situation of the sculpture. If it may be laid horizontally, and will bear to be oiled without injury, plaster of Paris may be advantageously employed, which may be poured over it to a convenient thickness, after oiling it, to prevent the plaster from sticking. A composition of bees wax, resin, and pitch, may also be used, which will be a very desirable mould, if many casts are to be taken from it. But if the situation of the sculpture be perpendicular, so that nothing can be poured upon it, then clay, or some similar substance, must be used. The best kind of clay for this purpose is that used by the sculptors for making their models with; it must be worked to a due consistence, and having spread it out to a size sufficient to cover all the surface, it must be sprinkled over with whiting, to prevent it from adhering to the original. Bees wax and dough, or the crumbs of new bread, may also be used for moulding some small subjects.

When there are undercuttings in the bas relief, they must be first filled up before it can be moulded, otherwise the mould could not be got off. When the casts are taken afterwards, these places must be worked out with a proper tool.

When the model, or original subject, is of a round form, or projects so much that it cannot be moulded in this manner, the mould must be divided into several parts; and it is frequently necessary to cast several parts separately, and afterwards to join them together. In this case, the plaster must be tempered with water to such a consistence, that it may be worked like soft paste, and must be laid on with some convenient instrument, compressing it so as to make it adapt itself to all parts of the surface. When the model is so covered to a convenient thickness, the whole must be left at rest till the plaster is set and firm, so as to bear dividing without falling to pieces, or being liable to be put out of its form by any slight violence; and it must then be divided into pieces, in order to its being taken off from the model, by cutting it with a knife with a very thin blade; and being divided, must be cautiously taken off, and kept till dry: but it must be observed, before the separation of the parts be made, to notch them across the joints, or lines of division, at proper distances, that

they may with ease and certainty be properly put together again. The art of properly dividing the moulds, in order to make them separate from the model, requires more dexterity and skill than any other thing in the art of casting, and does not admit of rules for the most advantageous conduct of it in every case. Where the subject is of a round or spheroidal form, it is best to divide the mould into three parts, which will then easily come off from the model; and the same will hold good of a cylinder, or any regular curve figure.

The mould being thus formed, and dry, and the parts put together, it must be first oiled, and placed in such a position that the hollow may lie upwards, and then filled with plaster mixed with water; and when the cast is perfectly set and dry, it must be taken out of the mould, and repaired when necessary, which finishes the operation.

In larger masses, where there would otherwise be a great thickness of the plaster, a core may be put within the mould, in order to produce a hollow in the cast, which both saves the expence of the plaster, and renders the cast lighter.

In the same manner, figures, busts, &c. may be cast of lead, or any other metal in the moulds of plaster or clay; taking care, however, that the moulds be perfectly dry; for should there be any moisture, the sudden heat of the metal would convert it into vapour, which would produce an explosion by its expansion, and blow the melted metal about.

183. *Isinglass Glue.*

Isinglass glue is made by dissolving beaten isinglass in water by boiling, and, having strained it through a course linen cloth, evaporating it again to such a consistence, that being cold, the glue will be perfectly hard and dry.

This cement is improved by dissolving the isinglass in any proof spirit by heat, or by adding to it, when dissolved in water, an equal quantity of spirits of wine.

It is still further improved by adding to the isinglass, previous to its solution in spirits, one third of its weight of gum ammoniac. Expose the mixture to a boiling heat, until the isinglass and gum are dissolved, and until a drop of the composition becomes stiff instantly as it cools. It will at any future time melt with a degree of heat little exceeding that of the human body, and, in consequence of so soon becoming stiff on cooling, forms a very valuable cement for many purposes, particularly for the very nice and delicate one of fixing on the antennæ, legs, &c. of insects in cabinets of natural history. The easy melting of this cement is no objection to its use, in cases where the articles themselves may afterwards be exposed to moderate heat; for it owes this property only to the presence of the spirit, which evaporates soon after it

has been applied. When used to join broken glass or china, the pieces to be joined should be previously warmed. Immersion in hot water will give them a sufficient degree of heat. Wipe off the water before applying the cement, which may be laid on with a pencil; then press the pieces together, binding them with a string or bit of soft wire, if necessary.

This isinglass glue is far preferable to common glue for nice purposes, being much stronger, and less liable to be softened either by heat or moisture.

184. *A good Glue for Sign-Boards, or any thing that must stand the weather.*

Melt common glue with water to a proper consistence; then add one eighth of boiled linseed oil, dropping it into the glue gently, and stirring it all the time.

A very strong glue is made by adding some powdered chalk to common glue.

Another that will resist water is made by adding half a pound of common glue to two quarts of skimmed milk.

185. *Lapland Glue.*

The bows of the Laplanders are composed of two pieces of wood glued together; one of them of birch, which is flexible, and the other of fir of the marshes, which is stiff, in order that the bow when bent may not break, and that when unbent it may not bend. When these two pieces of wood are bent, all the points of contact endeavour to disunite themselves, and to prevent this, the Laplanders employ the following cement: they take the skinns of the largest perches,* and having dried them, moisten them in cold water until they are so soft that they may be freed from the scales, which they throw away. They then put four or five of these skins into a rein-deer's bladder, or they wrap them up in the soft bark of the birch tree, in such a manner, that water cannot touch them, and place them thus covered into a pot of boiling water, with a stone above them to keep them at the bottom. When they have boiled about an hour, they take them from the bladder or bark, and they are then found to be soft and viscous. In this state they employ them for glueing together the two pieces of their bows, which they strongly compress and tie up till the glue is well dried. These pieces never afterwards separate.

186. *Turkey Cement, for joining Metals, Glass, &c.*

Dissolve five or six bits of mastich, as large as peas, in as

* It is probable that eel-skins would answer the same purpose.

much spirits of wine as will suffice to render it liquid; in another vessel dissolve as much isinglass (which has been previously soaked in water till it is swollen and soft,) in brandy or rum, as will make two ounces by measure, of strong glue, and add two small bits of gum galbanum, or ammoniacum, which must be rubbed or ground till they are dissolved; then mix the whole with a sufficient heat; keep it in a phial stopt, and when it is to be used set it in hot water.

187. *Another Cement that will stand the action of boiling water and steam.*

Take two ounces of sal ammoniac, one ounce of flowers of sulphur, and sixteen ounces of cast iron filings or borings. Mix all well together by rubbing them in a mortar, and keep the powder dry.

When the cement is wanted for use, take one part of the above powder, and twenty parts of clean iron borings or filings, and blend them intimately by grinding them in a mortar. Wet the compound with water, and when brought to a convenient consistence, apply it to the joints with a wooden or blunt iron spatula.

By a play of affinities, which those who are at all acquainted with chemistry will be at no loss to comprehend, a degree of action and re-action takes place among the ingredients, and between them and the iron surfaces, which at last causes the whole to unite as one mass. In fact, after a time, the mixture and the surfaces of the flanches become a species of pyrites (holding a very large proportion of iron,) all the parts of which cohere strongly together.

188. *Blood Cement.*

A cement often used by copper-smiths to lay over the rivets and edges of the sheets of copper in large boilers, to serve as an additional security to the joinings, and to secure cocks, &c. from leaking, is made by mixing pounded quick-lime with ox's blood. It must be applied fresh made, as it soon gets hard.

We believe if the properties of this cement were duly investigated, it would be found useful for many purposes to which it has never yet been applied. It is extremely cheap, and very durable.

189. *Japanese Cement, or Rice Glue.*

This elegant cement is made by mixing rice flour intimately with cold water, and then gently boiling it. It is beautifully white, and dries almost transparent. Papers pasted together by means of this cement will sooner separate in their

own substance than at the joining, which makes it extremely useful in the preparation of curious paper articles, as tea trays, ladies' dressing boxes, and other articles which require layers of paper to be cemented together. It is in every respect preferable to common paste made with wheat flour, for almost every purpose to which that article is usually applied. It answers well in particular, for pasting into books the copies of writings taken off by copying machines on unsized silver paper.

With this composition, made with a small quantity of water, that it may have a consistence similar to plastic clay, models, busts, statues, basso relievos, and the like, may be formed. When dry, the articles made of it are susceptible of a high polish; they are also very durable.

The Japanese make quadrille fish of this substance, which so nearly resemble those made of mother of pearl, that the officers of our East Indiamen are often imposed upon.

190. *A method of Silvering Ivory.*

Take a slip of ivory, immerse it in a weak solution of nitrate of silver, and let it remain in it till the ivory has acquired a bright yellow colour; then take it out of the solution, and immerse it in a tumbler of pure water, and expose it in the water, to the rays of a very bright sun. After the ivory has been exposed to the sun's rays for about two or three hours, it becomes black; but on rubbing it a little, the black surface will become changed into one of silver. Although this coating of silver is extremely thin, yet if the ivory be well impregnated with the nitrate of silver, the solution will penetrate to a considerable depth; and as fast as the silver wears off from the surface of the ivory, the nitrate below being exposed to the light, is converted into silver, and the ivory retains its metallic appearance.

191. *New method of making Cast Steel.*

This method has been lately invented in France. It is as follows:—Take small pieces of iron, and place them in a crucible, with a mixture of chalk or lime-stone, and the earth of Hessian crucibles. Six parts of chalk and six of this earth must be employed for twenty parts of the iron. The matters are to be so disposed, that, after fusion, the iron must be completely covered by them, to prevent it from coming into contact with the external air. The mixture is then to be gradually heated, and at last exposed to a heat capable of melting iron. If the fire be well kept up, an hour will generally be sufficient to convert two pounds of iron into excellent and exceedingly hard steel, capable of being forged; an advantage not possessed by steel made in the usual manner.

192. *To petrify wood, &c.*

Take equal quantities of gem salt, roch-alnm, white vinegar, calx, and pebble powder. Mix all these ingredients together, and there will happen an ebullition. If, after it is over, throw in this liquor any porous matter, and leave it there soaking for three, four, or five days, they will postively turn into petrifactions.

193. *To imitate tortoiseshell with horn.*

Take one ounce of gold litharge, and half an ounce of quick lime. Grind altogether, and mix it to the consistence of pap, with a sufficient quantity of chamber-lye. Put of this on the horn, and three or four hours afterwards it will be perfectly marked.

194. *A prepartion for the tortoise shell.*

Make a mixture as above, of quick lime, orpine, pearl ashes, and *aquafortis*. Mixed well together, and put your horn or tortoiseshell soaking in it.

195. *To dye bones and mould them in all manner of shapes.*

1. Boil together twelve pounds of quick lime, and one of calcined roch-alum, in water to the reduction of one third.—Bddd two more pounds of quick lime, and boil it again till it can carry an egg without its sinking to the bottom. Let it cool, then filter it.

2. Take twelve pounds of that liquor; half a pound of rasped Brasil wood, and four ounces of scarlet flocks; boil all about five minutes on a slow fire, then decant the clearest part of it, and put it by. Put on the *fæces* of Brasil wood and scarlet about four pounds of the first water; boil it the same time as the other, and decant the clearest part of it on the other. Repeat this operation, till the new added water draws no more colour from the *fæces*.

3. Now rasp any quantity of bones, and boil them in clear lime water. Then take them out, put them in a matrass and over them some of the tinged water, so as to soak them. Place the matrass on a mild sand bath and evaporate the liquor. Add some more liquor, and evaporate it again, continuing to add and evaporate the tinged liquor, till the rasped bones are all turned into a soft paste.

4. Take this paste, and mould if as you like, in tin or other moulds, to make whatever thing or figure you want. Set it in the mould for a day or two, till it acquired the shape you

wish it; to harden it, boil it in a water of alum and salt-petre first, afterwards, in oil of nut. These figures look incontestibly to be made of bones, without conceiving how they can be made such, out of that matter, and one solid piece.

196. *To dye bones in black.*

Take six ounces of litharge, and the same quantity of quick lime. Boil all in common water, along with the bones. Keep stirring, till the water begins to boil. Then take it out, and never cease stirring till the water is cold again; by that time the bones will be dyed black.

197. *To soften bones.*

Take equal parts of Roman vitriol, and common salt.—Distil the spirits out by the root. If in the water you get from the distillation, you put the bones a soaking, they will become as soft as wax.

198. *To dye bones in green.*

Pound well together in a quart of strong vinegar three ounces of verdigrease, as much of brass filings, and a handful of rue. When done, put all in a glass vessel along with the bones you want to dye, and stop it well. Carry this into a cold cellar, leave it for a fortnight, the bones will be dyed green.

199. *A salt for hardening soft bones.*

Take equal quantities of ummoniac, common decrepiated and gem salts, as well as of *plumeum*, *saccarinum*, roch and shell alums. Pulverise and mix all together, then put it in a glass vessel well stopped, which bury in hot horse dung, that the matter should melt into water. Congeal it on warm embers. Then make it return into a *delequium* again, by means of the horse dung, as before. When thus liquified for the second time, it is fit for use. Keep it to harden and consolidate any thing, smear it over with it.

200. *To dye bones and ivory of a fine red.*

1. Boil scarlet flocks in clear water assisted with pearl ashes, to draw the colour the better; then clarify it with roch-alum, and strain this tincture through a piece of linnen.

2. To dye afterwards any bones or ivory in red, you must rub them first with *aquafortis*, and them immediately with this tincture.

201. *To make a paste in imitation of black marble.*

Dissolve two ounces of spalt on a gentle fire, in a glazed pipkin. When in perfect fusion, add a third part of harable, ready melted, stir all together. When both are well mixed and united, take the pipkin off the fire, and throw the contents, boiling hot, into a mould, of a fine polish in the inside. When cold and dry, take the piece from off the mould, and you will find that nothing can imitate so well black marble as this deceptive composition.

202. *To dye marble, or alabaster, blue or purple.*

1. Pound together in a marble mortar, parsnips and purple lilies, with a sufficient quantity of white wine vinegar.—Proportion the quantity of parsnips and lilies, to each other, according to the hue you wish to give the liquor. If you cannot get one of these two juices, make use of that you can get; and to every pound of liquor, mixed and prepared, put an ounce of alum.

2. In this dye put your marble or albaster, and boil them, supposing they are not too inconsiderable to go into the vessel with the liquor. And if they be, you must heat one part of it as much as you possibly can, then dye it with the liquor boiling hot, and thus proceed from place to place, till you have dyed it all over.

203. *Of the choice and composition of metals.*

Any metal whatever may be used for the casting of figures, though the general composition runs as follows.

1. For the fine bronze figures, the alloy is half brass, half copper. The Egyptians who are said to be the inventors of that art, used to employ two thirds of brass against one of copper.

2. Brass is made with copper and calamine. One hundred weight of calamine renders one hundred *per cent.* Calamine is a stone from which a yellow dye is drawn. It is to be found in France and at Leige.

3. Good copper ought to be beaten, not molten, when intended for statues. You must guard also against using putty, when in alloy with lead.

4. Copper may be forged either hot or cold. But brass breaks when cold, and suffers the hammer only when hot.

5. There is a sort of metalic stone called zinc, which comes from Egypt; it renders the copper of a much finer yellow than the calamine; but as it is both dearer and scarcer, they are not so ready to use it.

6. As for the composition for making of bells, it is twenty

pounds weight of pewter for each hundred of copper. And the artillery pieces take but ten pounds only of pewter to one hundred of the other. This last composition is not good for the casting of figures, as it is both too hard and too brittle.

204. *A good shining ink.*

1. Put four quarts of warm water in a glazed pipkin. Add eight ounces of turpentine oil, and one pound of gall-nuts bruised in a mortar. Let the whole infuse thus for a week, then boil it gently, till with a pen you may draw a stroke yellow and shiny with it. Strain it through a strong cloth. Set it on a blasting fire, and as soon as it boils, add seven ounces of green vitriol to it, keep stiring it with a stick till it is perfectly dissolved. Let this rest for two days, without disturbing it. There will be a skim on the top, which must be thrown off. Decant next the clearest part into another vessel, which you set on a gentle fire, to evaporate about two fingers of the liquor, then let it rest four or five days, and it will be fit for use.

2. Rain water, or that in which walnuts have been infused are both very good for making of ink.

3. With white wine, or old beer, you may likewise make very good shining ink.

4. A carp's gall is very proper to mix among it.

205. *To write on grease, and make the ink run on it.*

1. Cut a bullock's gall open into a pan, and put a handful of salt and about a quarter of a pint of vinegar to it, which you stir and mix well. Thus you may keep the gall for twelve months, without its corrupting.

2. When you are writing, and you find your paper or parchment greasy, put a drop of that gall among your ink in the ink-horn, and you will find no more difficulty to make your pen mark.

206. *An ink-stone, in which ink stands may be made, and with which you may write without ink.*

Take gum arabic, fourteen ounces; lamp black, thirteen; and burnt willow wood coals, three. Pound the gum into an impalpable powder, and dissolve it into a pint of common water. This done knead your abovementioned powders with part of this gum water, so as to make a paste or dough of them, as it were for bread. With this dough form ink-stands, of the shape and form you like best, and in these ink-stands, while the composition is still soft, you may stamp a few small holes.

2. This done, dry these stands in an ardent furnace for four hours, or in the shade, a sufficient time. When dry brush them over with your aforementioned gum-water, till they appear as black and shiny as jet, and as hard as marble.

3. When you want to use them, put a few drops of water in one of the holes, and put a pen to soak in it at the same time. If the water be but just put in, the ink will not be quite so black; but if it have remained a little while, it will be as black as the blackest of any ink.

207. *To write with common clear water.*

Take gall nut powder, and vitriol calcined in the sun to whiteness, of each four ounces, and sandarak, one and a half. All being pulverised and mixed, rub your paper with that powder; then steeping your pen in any common water, and writing with it, it will appear black like any other ink.

208. *A good ink, both for drawing and writing.*

1. Bruise with a hammer one pound of gall-nuts, and put it to infuse for a fortnight in the sun, in two quarts of clear water, stirring it now and then. Strain this infusion through a sieve or cloth in a glazed pipkin.

2. In another vessel, put two ounces of gum-arabic; and half of the above infusion. In the other half which remains to dissolve two ounces and a half of German green vitriol, and let it infuse, for four-and-twenty hours. Join afterwards, both infusions together; and a week afterwards or therebouts, the ink will be very good, and fit for use.

209. *To make very good ink without gall-nuts; which will be equally good to wash drawings and plans, and strike very neat lines with the pen.*

In half a pound of honey put one yolk of an egg, and beat it a good while with a flat stick. Then asperse the matter over with three drachms of gum-arabic in subtile powder. Let this stay about three days, during which, beat it often with a stick of walnut-tree wood.

2. Next to this, put to it such a quantity of lamp-black as will make it in consistence of a dough, which you make in cakes, and dry it in the air, to render it portable.

3. When you want to use it, dilute it with water or with a lye made either of vine wood ashes, or walnut-tree, or oak, or even peach stones.

210. *An invisible ink.*

1. Dissolve one ounce of ammoniac salt in a glass tumbler

of water, and write. When you wish to make the writing appear, hold the paper to the fire, and it will become black.

2. The same may be done with the juice of an onion.

211. *To make good India imk.*

Burn some lamp-black in a crucible till the fume which arises in doing it, has entirely subsided; grind it next on porphyry, or marble, with a pretty strong water of gum-tragacanth. Add an equal quantity of indigo burnt, and grinded in the same manner. Then mix them both together on the stone, and grind them for two hours. Gather up the composition, in a flat square of the height and thickness you are willing to give to your sticks. Cut these with a knife to your intended size, and put them, if you chuse, into an iron mould; and lest the paste should stick to them, rub the inside of the mould with lamp or ivory black, or with peach stone dust, which you burn in a crucible stifled with a brick to stop it well.

212. *Red Ink.*

Dissolve half an ounce of gum-arabic in three ounces of rose water. Then with this water, dilute cinnabar, vermilion, or minium.

Ink of any colour may be made in the same manner, by substituting only a proper colouring ingredient to the aforementioned cinnabar, &c.

213. *A green ink.*

Grind together verdigrease, saffron, rue juice, then dilute this paste in the abovementioned gum rose water.

214. *To make an ink which appears and disappears alternately.*

Write with an infusion of gall nuts filtered through brown paper, and the writing will not be visible. When you want to make it appear, steep a little sponge, or bit of cotton, into an infusion of vitriol, and pass it over the written place of the paper; the writing will immediately appear. To rub it off, and make the paper look all white again, do the same with spirit of vitriol, and all the writing will be gone. To make it visible again, rub the paper over with oil of tartar; and thus continue for ever.

215. *The invisible method of conveying secrets.*

nfuse for twenty-four hours, half an ounce of gold lith-

arge in half a pint of distilled white wine vinegar, and shake the bottle often during the first twelve hours of the infusion. When all is well settled, decant the clear part into another phial, which you must stop carefully, and throw the fæces away.

If you have any secret to communicate to a friend, write it with this liquor, and it will be no more visible than if you wrote it with clear pump water.

216. *An ink which will go off in six days.*

Write with willow-wood cinders, pulverised and diluted with common water.

217. *Another which you may rub off when you please.*

Dilute gunpowder in common water, and write with it on a piece of parchment; then when you mant to efface it, take your handkerchief, and rub it off.

218. *Powder ink.*

Take equal parts of black rosin, burnt peach, or apricot stones, vitriol and gall nuts, and two of gum-arabic. Put the whole in powder, or in a cake, as you like best.

219. *A gold colour ink, without gold.*

Put half a drachm of saffron, one of auripigment, and one a fortnight in hot horse dung. At the end of that term, add she-goats, 5 or 6 or jack gall, in a glass bottle; and set for a gill of gum-water; and place it again for the same length of time in horse dung. Then it is fit for use.

220. *To write in silver without silver.*

Mix so well one ounce of the finest pewter and two of quicksilver together, that both become quite fluid. Then grind it on porphyry with gum-water, and write with it. All the writing will look then as if done with silver.

221. *A blue ink.*

Dilute half a pound of indigo with some flake white and sugar in a sufficient quantity of gum-water.

The same may be done with ultramarine, and gum-water.

222. *A yellow ink.*

Dilute in gum-water some saffron, or French berries, or gamboge, and you will have a yellow ink. The same may

be done with any other colouring ingredient, to obtain an ink of the colour one likes to have.

223. *A green ink, which may keep two years.*

Put a pint of water on the fire in a varnished pipkin ; and when it is ready to boil, throw in two ounces of verdigrease pounded, and boil it gently on a slow fire for the space of half an hour, stirring it often during that time with a wooden spatula. Then add one ounce of white tartar, well pulverised, and boil it one quarter of an hour. Strain two or three times through a cloth, then set it before the fire to evaporate part of it, in order to make it more shiny. But observe that the more it boils, the more it loses of its green colour, and approaches to the blue.

224. *A way of writing which will not be visible, unless you hold the paper in the sun, or to the light of a candle.*

Take flake white, or any other whitening, and dilute it in a water impregnated with gum-adragant. If you write with this liquor, the writing will not be perceivable, unless you apply the paper to the sun, or the light of a candle. The reason why it is so, is, that the rays of light will not find the same facility to pass through the letters formed with this liquor, as through the other parts of the paper.

225. *A secret to revive old writings, which are almost defaced.*

Boil gall-nuts into wine; then steeping a sponge into that liquor, and passing it on the lines of the old writing, all the letters which were almost undecypherable will appear as fresh as newly done.

226. *A common ink.*

1. Bruise six ounces of gall-nuts and as much gum-arabic, and nine of green vitriol. Put them afterwards in three quarts, at least, of river, spring, or rain water. Stir the composition three or four times a day. And after seven days infusion, strain all through a cloth, your ink is made.

2. This ground, as well as that above, will admit of fresh water being put to it, with an addition of vitriol also.

227. *To whiten and silver Copper Medals.*

1. Take filings from Cornwall pewter, and make a bed of them at the bottom of a pipkin. On this bed lay one of

your medals, taking care, however, they should not touch each other. Make another bed of filings over these medals, and one of medals again on these filings. Continue this alternate stratification of medals and filings, till you have laid all the medals you wanted to whiten.

2. When this is done, fill up your pan with water, and put on it a powder composed of roch-alum and tartar from Montpellier, well grinded and mixed together. Boil the whole till the whitening of the medals is complete.

N. B. They must have previously been cleansed with soft sand, or strong lye; to purge them from any grease.

228. *A water to gild iron.*

In three pounds of river-water, boil roch-alum, one ounce, Roman vitriol, as much, verdigrease, half an ounce, gem salt, three, and orpine, one. Then add tartar half an ounce, and the same quantity of common salt. Boil it again with this addition. Now heat your iron, and when warm, rub it over with this stuff quite hot, then dry it by the fire, and burnish.

229. *To whiten exteriorly copper statues.*

Take silver crystals, ammoniac, gem, common and alkali salts, of each of all these two drachms. Make all into a paste with common water. Lay your figures over with it, and set them on red-hot charcoals till they smoak no more.

230. *To gild silver in water gilding, without the assistance of mercury.*

1. Take first the finest gold, forge it weakish, then cut it in bits and neal it, on an iron plate, or in a crucible.

2. Have next a glass matrass, put your gold in, and to every drachm of gold, put half a pound of ammoniac salt, and two ounces of good *aquafortis*. Cover the matrass with a sheet of paper, turned conically by one of its corners upon one of the long sides, so as to form a funnel with the smallest, and not quite close, but terminated in a small orifice, to give a free passage to the fumes of the *aquafortis*. Set this matrass on a very slow fire, that the gold may have time to dissolve gently and gradually, and shake often the matrass, to help the dissolution. Be very careful not to make the fire too strong; for the gold would infallibly sublime, and waste itself all into vapours.

3. When the gold is entirely dissolved, pour this liquor into a glass, or china bowl; wet some old coarse linen rags on them, which set to drain on small sticks on another bowl, do-

ing the same with what drains from them till you have used all your liquor; then dry them before a gentle fire.

4. When dry, lay them on a marble stone, and set them on fire. And as soon as they are consumed, grind them into a fine powder, which put afterwards into a crucible on a little fire. When this powder is lighted like sparkles of fire, put it on the marble again, and stir it with an iron rod till you see no more fire. Grind it then again as before, as much as you possibly can, and it is fit for gilding any sort of silver work you please.

231. *A water which gilds copper and bronze. A secret very useful for watch and pin-makers.*

Dissolve equal parts of green vitriol and ammoniac salt in good double distilled vinegar; then vaporate the vinegar, and put it in the retort to distil. If in the product of the distillation you steep your metal after being polished and made hot, it will come out perfectly well gilt.

232. *To gild steel or iron, after being well polished.*

Take seven ounces of orpine; *terra merita*, one and a half; succotrine aloes, four and a half; gamboge, three and a half. Put all into powder, and put it in a retort, with so much of pickle water as will cover these powders by two fingers. Stir well, and mix all together, let it infuse four and twenty hours and distil. With the liquor which comes from the distillation, keep by for use, rub the steel, iron, or copper, and set it to dry in the shade.

233. *A composition to lay on lead, tin, or any other metal, in order to hold fast the ready gilt leaves of pewter which are applied on it; useful for gilding on high steeples, domes, &c.*

1. Melt together, on a slow fire, black pitch, two pounds; oil of turpentine, four ounces; and a little rosin. When the whole is dissolved and mixed well into a kind of varnish, lay a coat of it on your work.

2. Upon steeples, the common method of gilding cannot, on account of the wind, be practised; have only the exact measures and dimensions of the place intended to be gilt, then, at home, and at leisure, cut to them some fine leaves of pewter, and gild them as usual. When done, you have no more to do but to carry up these pewter leaves, rolled in a basket, and having burnished the place on which they are to be applied with the above composition, lay the gilt pewter leaves on it, and they will stand fast enough.

234. *To clean and whiten silver.*

1. Rasp four ounces of dry white soap in a dish. Pour a pint of warm water on it. In another dish put a pennyworth of wine lye dried in cakes, and the same quantity of the same water. In a third dish put also another pennyworth of pearl ashes, with another similar quantity of the same water.

2. Then, with a hair brush steeped first in the wine lye, then in the pearl ash, and lastly in the soap liquors, rub your silver plate, and wash it afterwards with warm water, and wipe it with a dry cloth kept on a horse before the fire for that purpose.

235. *The preparation of gold in shell.*

Take ammoniac salt, and gold leaves, equal quantities.—Bruise this in a mortar for two or three hours; and towards the end add a discretionable quantity of honey.

236. *To bronze in gold colour.*

Rub the figure first with *aquafortis*, in order to cleanse and ungrease it well. Then grind on porphyry, into a subtile powder, and mix with lintseed oil, equal quantities of *terra merita* and gold litharge. With this composition paint the figure over.

237. *Varnish to be laid on gilding and silvering.*

Grind verdigrease, on marble, with common water, in which you have infused saffron for eight hours.

238. *A water to gild Iron with.*

1. Put in a glass bottle, with a pint of river water, one ounce of white copperas, and as much of white alum; two drachms of verdigrease, and the same quantity of common salt. Boil all together to the reduction of one half. Then stop the bottle well, for fear the contents should lose their strength.

2. To gild the iron with it, make it red hot in the fire, and plunge it in this liquor.

239. *How to get the gold or silver out of gilt plates.*

1. Mix together one ounce of *aquafortis*, and one of spring water, with half an ounce of common, and one drachm of ammoniac salts. Put all on the fire, and boil it; then put in the plate to soak from which you want to get the gold or silver out. A little while after, take your plate out, and scrape it over the liquor:

2. The gold will remain suspended in this regal-water; and to make a separation of them, pour in it double the quantity of common water; or again, throw a halfpenny in it, and boil it, and all the gold will fix itself to it.

240. *To gild paper on the edge.*

1. Beat the white of an egg in three times its quantity of common water, and beat it till it is all come into a froth.—Let it settle into water again, and lay a coat of it on the edge of your paper.

2. Next lay another of bol armenian and ammoniac salt, grinded with soap-suds. Then put the gold, and let it dry, before burnishing it.

241. *To gild without gold.*

Open a hen's egg by one end, and get all out from the inside. Refill it again with chalidonia's juice and mercury; then stop it well with mastich, and put it under a hen which just begins to set. When the time of hatching is come, the composition will be done, and fit for gilding.

242. *To gild on calf and sheepskin.*

Wet the leather with whites of eggs. When dry, rub it with your hand, and a little olive oil; then put the gold leaf, and apply the hot iron on it. Whatever the hot iron shall not have touched will go off by brushing.

243. *Gold and silver in shell.*

1. Take saltpetre, gum arabic, and gold leaves, wash them all together in common water. The gold will sink to the bottom, whence pouring the water off you may then put in the shell.

2. The silver is worked in the same manner, except the saltpetre, instead of which you put white salt.

244. *To dye any metal, or stone, gold colour, without gold.*

Grind together in a subtile powder ammoniac salt, white vitriol, saltpetre, and verdigrease. Cover the metal, or stone you want to dye, all over with this powder. Set it thus covered on the fire, and let it be there a full hour; then taking it out, plunge it in chamber-lye.

245. *To whiten copper.*

Take one ounce of zinc, one drachm and a third part of it of sublimed mercury. Grind all into a powder, then rub

246. *To whiten iron like silver.*

Mix ammoniac salt powder, and quick lime, in cold water. Then make your iron red hot several times, and each time, plunge it in that dissolution. It will turn as white as silver.

The Art of Dying Woods, Bones, &c.

247. *The composition for red.*

Chop Brasil wood, very fine, and boil it in common water, till it has acquired an agreeable colour, then strain it through a cloth.

2. Give your wood first a coat of yellow, made of saffron, diluted in water. Then the wood being thus previously tinged with a pale yellow, and dried, give afterwards several coats of the Brasil wood water, till the hue pleases you.

3. When the last coat is dry, burnish it with the burnisher, and lay another coat of drying varnish with the palm of your hand, and you will have a red oranged very agreeable.

4. If you want a deeper red, or rather a darker, boil the Brasil wood in water impregnated with a dissolution of alum, or quick lime.

248. *To dye wood in a purplish colour.*

Soak Dutch turnsol in water; add a tincture of Brasil wood made in lime water; and you will obtain a purple, with which you may dye your wood, and then burnish and varnish as usual.

249. *A blue purple.*

Take that sort of German turnsol which painters use with size. Dissolve it in water and strain it through a linen cloth. Give a coat of this dye to the wood; and if the hue be too strong, give it another of a paler dye, by adding clear water to a part of the other. When dry, burnish it as usual.

250. *A blue for wood.*

Slack lime in water, and decant it out of the ground. In three pints of this water dissolve four ounces of turnsol, and boil it one hour. Then give several coats of it to your wood.

251. *A green.*

Grind Spanish verdigrease into a subtile powder with strong vinegar. Add and mix well with this, two ounces of

green vitriol. Boil all of it a quarter of an hour in two quarts of water, and put your wood soaking till the colour be to your liking. For the rest proceed as above.

252. *A yellow.*

Dissolve turnsol in two quarts of water. Then grind some indigo on marble with that water, and set it in a vessel on the fire with weak size to dilute it. When done, give a coat of this dye to your wood with a brush, and when dry, polish it with the burnisher.

253. *Another finer yellow.*

Four ounces of French berries, boiled for about a quarter of an hour in a quart of water, with about the bulk of a filbert of roch-alum. Then soak the wood in it.

254. *To dye wood a fine polished white.*

Take the finest English white chalk, and grind it in subtile powder on marble, then let it dry, and set it in a pipkin on the fire with a weak sized water, having great care not to let it turn brown. When it is tolerably hot, give first a coat of size to your wood, and let it dry: then give one or two coats of the aforesaid white over it. These being dry also, polish with the rushes, and burnish with the burnisher.

255. *To dye in polished black.*

Grind lamp black on marble with gum water. Put it next in a pipkin, and give a coat of this, with a brush to your wood; then polish it when dry.

256. *To imitate ebony.*

Infuse gall-nuts in vinegar, wherein you have soaked rusty nails; then rub your wood with this, let it dry, polish and burnish.

257. *A fine black easily made.*

Take good ink, put it in a stone pan, new and well nealed, then set it in the sun to exsiccate it into a cake. When dry, take and scrape it out from the pan with a knife, and grind it into an impalpable powder on marble. This powder diluted with varnish, will produce a fine black.

258. *To dye wood silver fashion.*

Pound tin glass, in a mortar, and reduce it into powder.—

Add water to it by degrees, till it come into a liquid like liquor for painting Put it in a clean pipkin, with size, and set it on the fire to warm. Brush your wood with this liquor, and when it is dry, burnish it.

259. *To dye in gold, silver, or copper.*

Pound very fine, in a mortar, some roch-chrystal with clear water, set it to warm in a new pipkin with a little size, and give a coat of it on your wood with a brush. When dry, rub a piece of gold, silver, or copper, on the wood thus prepared, and it will assume the colour of such of these metals as you rub it with. After this is done, burnish it as usual.

260. *To give nut, or pear tree, what undulation you like.*

Slack some quick lime in chamber lye. Then with a brush dipped in it form your undulation on the wood according to your fancy. And when dry, rub it well with a rind of pork.

261. *To imitate the root of nut-tree.*

Give seven or eight coats of size to your wood, till it remains shiny. Then before your size is quite dry, strike here and there a confused quantity of spots with bistre grinded with common water. When dry, varnish it with the Chinese varnish.

262. *To give a fine colour to the cherry-tree wood.*

Take one ounce of orchanetta ; cut it in two or three bits, and put it to soak for forty-eight hours in three ounces of good oil of olive. Then with this oil anoint your cherry-tree wood after it is worked and shaped as you intend it ; it will give a fine lustre.

263. *To marble wood.*

1. Give it a coat of black, diluted in varnish. Repeat it one, two, three or as many times as you think proper ; then polish it as usual.

2. Dilute some white varnish made with white gum, or shell-lac, and white sandarac. Lay this white on the black ground, tracing with it what oddities you like. When dry, give a light rub with rushes, then wipe it, and give a last coat of fine transparent white varnish, in order to preserve the brightness. Let this dry at leisure, then polish it.

264. *To imitate white marble.*

Break and calcine the finest white marble you can find ;

grind it as fine as you can, and dilute it with size. Lay two coats of this on your wood, which, when dry, polish and varnish as before directed.

265. *To imitate black marble.*

Burn some lamp black in a shovel, red hot, then grind it with brandy. For the bigness of a egg of black, put the size of a pea of lead in drops, as much of tallow, and the same quantity of soap. Grind and mix these together, then dilute it with a very weak size water. Give four coats of this, and when dry, polish as usual.

266. *To take the impression of any seal.*

1. Take half a pound of mercury; the same quantity of chrystalline vitriol; as much verdigrease. Pulverise well these two last ingredients, and put them along with the first in a new iron pan, with smith's forge water. Stir all well with a wooden spatula, till the mercury is perfectly incorporated with the powders. Then wash that paste with cold water, and change it till it remains quite clear as when you put it in. Put the lump in the air, it will harden.

2. When you want to take the impression of a seal with it, place it over the fire on an iron plate. When there appears on it some drops like pearls, then it is hot enough; take it off and knead it in your hands with your fingers, it will become pliable like wax; smoothen one side of it, and apply it on the seal, pressing it to make it take the impression.—When done, lift it up, and set it in the air, where it will come again as hard as metal, and will serve you to seal the same letter as the original seal, without probability of discovering it, should even the real one be laid on it.

267. *To get Birds with white feathers.*

Make a mixture of *semper vivum-majus's* juice, and olive oil, and rub with it the eggs on which the hen is setting. All the birds which shall come from those eggs will be white feathered.

268. *To soften Ivory.*

In three ounces of spirit of nitre, and fifteen of white wine, or even mere spring water, mixed together, put your ivory a soaking. And in three or four days, it will be so soft as to obey under the fingers.

269. *To dye Ivory thus softened.*

1. Dissolve, in spirit of wine, such colour you want to dye

your ivory with. And when the spirit of wine shall be sufficiently tinged with the colour you have put in, plunge your ivory in it, and leave it there till it is sufficiently penetrated with it, and dyed inwardly. Then give that ivory what form you will.

2. To harden it afterwards, wrap it in a sheet of white paper, and cover it with decrepitated common salt, and the driest you can make it; in which situation leave it twenty-four hours.

270. *To whiten Ivory, which has been spoiled.*

Take roch alum, dissolve it in water, in a sufficient quantity, to render the water all milky. Boil this liquor, and soak your ivory in it for one hour, then rub it with a hair brush. When done, wrap it in a wet piece of linen to dry it leisurely and gradually, otherwise it would certainly split.

271. *To whiten Green Ivory: and whiten again that which has turned of a Brown Yellow.*

1. Slack some lime in water, put your ivory in that water, after decanted from the ground, and boil it till it looks white.

2. To polish, set it on the turner's wheel, and after having worked it, take rushes and pumice-stone subtile powder with water, rub it till it looks perfectly smooth. Next to that, heat it, by turning it against a piece of linen, or sheepskin leather, and when hot, rub it over with a little whitening diluted in oil of olive, continuing turning as before; then with a little dry whitening, and a piece of soft white rag. When this is performed the ivory will look as white as snow.

272. *The preparation of the ink which serves to write inscriptions, epitaphs, &c. on stones, marbles, &c.*

This ink is made with nothing else but a mixture of lint-seed oil black, and black pitch dissolved over a small fire.—They call this also *stucco*.

273. *An ink which may be made instantly.*

Take gum-arabic, and vitriol, of each one ounce: bruised gall-nuts one and a half. Put all in ten ounces of white wine, or vinegar; and, no longer than one hour after, you may use it.

274. *A portable ink, without either gall-nut or vitriol.*

1. Take one pound of honey, and two yolks of raw eggs. Dilute and mix them all well with the honey. Add three drachms of gum-arabic in subtile powder. Stir well the

whole together during three days, and several times a day, with a fig-tree stick flattened at one of the ends. Then, to that first composition add again as much of that sort of lamp-black which is used in printers ink, as may be required to thicken the whole into a lump, which you let dry, and keep in that state.

2. When you want to use it, take a bit of it and dilute it in any common water, or lye, and it will write like any other ink.

275. *Another portable ink, in powder.*

This is made with equal quantities of gall-nuts and vitriol; a little gum-arabic, and still less of sandarak of the antients. You pound or grind each drug well, and mix the powders together, which are to be very fine. Lay some of this compound powder on your paper, and spread it well with your fingers. Then dipping your pen into clear water, you may write on this prepared paper, and it will appear as black as any other ink.

276. *Another portable powder, to make ink instantly.*

Take and reduce into a subtile powder ten ounces of gall-nuts, three of Roman vitriol, otherwise green copperas; with two ounces of roch-alum and as much of gum-arabic. Now when you want to make ink, put a little of this mixture into a glass of white wine, and it will instantly blacken, and be fit for use.

277. *Of the use of sugar candy in ink.*

Sugar-candy has the admirable virtue of restoring bad ink into good. It blackens it, renders it shiny, and makes it run properly. Therefore it is most advisable to put some powder of white sugar candy into the bottle or ink-horn.

278. *A sort of black ink fit for painting figures, and to write upon stuffs, and linen, as well as on paper.*

Bruise on the stone one ounce of gall-nuts, and put it in a pint of strong white wine vinegar on the fire, with two ounces of iron filings. Evaporate away about one half of the liquor in boiling it gently, strain the remainder, and keep it for use.

It would not be improper to add a little gum-arabic to the above composition; however, it may as well be let alone.

279. *To prevent ink from freezing in winter.*

If instead of water, you make use of brandy with the same ingredients which enter into the composition of any ink, that ink never will freeze. You may also put some into the ink already made otherwise, and it will assist a good deal in preventing the frost from acting upon it.

280. *To make Canton's Phosphorus.*

Take some oyster shells; calcine them, by keeping them in a good fire for about an hour. Select out of the calcined shells the purest and whitest parts, and pound and sift them. To three parts of this lime, add one of flowers of sulphur; mix them well together, and put them well pressed into a crucible. Place it in a good fire, where it must be kept red hot for an hour at least; it may then be taken out to cool. When it is cold, break the mass to pieces, and select out of it the brightest part, which will shine in the dark.

281. *To make a Phosphoric Fire Bottle.*

Take a very small phial, and put into it a bit of phosphorus as large as a pea, and fill up the bottle with lime. Fix an iron vessel, as a shovel, for instance, with common sand, and put it over the fire. Set the phial in this sand, having loosely stopped it with a cork. Stir about the ingredients with a wire, and mix them together, taking care that the phosphorus does not catch fire by too great an access of air. Keep the bottle in the sand till the phosphorus is thoroughly incorporated with the lime, when it will be of a reddish yellow.

This bottle is extremely convenient for procuring an instantaneous light in the dark. For this purpose, nothing more is necessary than to uncork the bottle, and to introduce a brimstone match, stirring it about a little, by which it will catch fire and light.

The bottle must be always kept carefully corked, and opened as seldom as possible.

A more durable kind may be made by uniting together one part of sulphur with eight of phosphorus. When this is used, a match is introduced into it, and then rubbed upon a bit of cork.

282. *Changing Iron apparently into Copper.*

Dissolve some blue vitriol (sulphrate of copper) in water, and dip into the solution a piece of bright iron or steel; in a few seconds it may be taken out, when it will be apparent-

ly turned to copper. This is a deception; the iron is not changed into copper; it is only encrusted over with that metal, as may be easily seen by removing the copper by a file. The iron having a stronger attraction for sulphuric acid than copper, it takes the acid from the latter, which is consequently precipitated. This process is used for obtaining the copper from waters near mines that contain a great quantity of that metal. Iron plates are put into them, which become incrusted with copper, which is scraped off.

283. *Artificial Fire-Works.*

Artificial fire-works are of two kinds—those made of gunpowder, nitre, and other inflammable substances and filings of the metals, camphor, &c.; and those produced by hydrogen or inflamible air.

Those made with gun-powder are well known, and are called rockets, fire-wheels, tourbillons, &c.

Of these, the most usual are rockets. They are made by ramming into strong cylindrical paper cases put into wooden moulds, like small hollow columns, powdered gunpowder, or the ingredients of which it is composed, viz.—saltpetre, sulphur, and charcoal, very dry.

If you would represent a fiery rain falling from the rocket, mix among your charge a composition of powdered glass, filings of iron, and saw-dust: this shower is called the peacock's tail, on account of the various colours that appear in it. Camphor mixed with the charge, produces white or pale fire; resin a reddish colour, sulphur a blue, sal ammoniac a green, antimony a reddish yellow, ivory shavings a silvery white, pitch a deep or dark coloured fire, and steel filings, beautiful corruscations and sparks.

Sticks are fastened to the rockets, by which they are projected into the air, after they have been lighted: the charge burning with great intensity at one end, acts upon the air, which, in its turn, re-acts upon the rocket, and causes it to ascend, on the same principle as a boat is put off by a man in it, who pushes against the shore with a boat-hook.

284. *To lay Mezzotinto Prints upon Glass.*

Take what mezzotinto prints you please; cut off the margin, and lay it flat in a dish of clear hot water; let it remain on the surface till it sinks. When you take it out, be careful not to break it, and press it betwixt clean cloth or paper, so that no water may appear on the surface, but the prints be quite damp: then lay it, face uppermost, on a flat table; have ready a plate of pure crown glass, free from all spots or scratches; lay some Venice turpentine all over one side of it

with a soft brush, and hold it to the fire a little, to make it run quite equal and thin; then let it fall gently on the print. Press it down, that the turpentine may stick to the print; and also press the print with your fingers, from the middle to the edges of the glass, so that no blisters may remain. Wet your print now with a soft cloth, and rub it gently with your finger, and the paper will peel off, leaving only the impression upon the glass. When it is dry, wet it over with oil of turpentine till it is transparent, and set it by to dry, when it will be fit for painting. The colours used for painting in this manner, are the usual oil colours, and there is nothing in the process particular.

285. *Method of distinguishing Iron from Steel.*

Drop a little weak aqua fortis on the metal; let it remain for a few minutes, and then wash it off with water. If it is steel, the spot will be black; but if iron, the spot will be whitish grey.

286. *To procure Animalculæ for the Microscope.*

The surface of infused liquors is generally covered with a thin pellicle, which is easily broken, but acquires thickness by standing; the greatest number of animalculæ are generally to be found in this superficial film.

To make an infusion of pepper. Cover the bottom of an open jar, about half an inch thick, with common black pepper bruised; pour as much soft water in the vessel as will rise about an inch above the pepper. The pepper and water are then to be well shaken together; after which they must not be stirred, but be left exposed to the air for a few days, when a thin pellicle will be formed on the surface of the water, containing millions of animalculæ.

To procure the eels in paste, boil a little flour and water till it becomes of a moderate consistence; expose it to the air in an open vessel, and beat it together from time to time, to prevent the surface from growing hard or mouldy: after a few days, especially in summer time, it will turn sour; then, if it be examined with attention, you will find myriads of eels on the surface. Apply them to the microscope on a slip of flat glass, first putting on it a drop of water, taken up by the head of a pin, for them to swim in.

287. *A process for purifying Fish Oil.*

Take a gallon of crude stinking oil, and put to it a pint of water poured off from two ounces of lime slacked in the air; stir the mixture up several times for the first twenty-four

hours; then let it stand a day, and the lime water will sink below the oil, which must be carefully separated from it.

288. *REFINING METALS.*

The term *refining* signifies the purification of some substance: but we mean to confine it at present to the separation of gold, silver, and copper, from each other; and obtaining each of them in a pure state.

Cupellation.

Gold and Silver being the only metals capable of withstanding the action of very strong heat, are therefore called *perfect* metals. All other metals are reduced to the state of oxydes when exposed to a violent fire with access of air. Gold and silver may therefore be purified from all the baser metals, by keeping them fused till the alloy be destroyed: but this process would be very expensive, from the great consumption of fuel, and would be exceedingly tedious. A shorter and more advantageous method of performing this operation has been discovered.

A certain quantity of lead is added to the alloy of gold and silver, and the whole is exposed to the action of the fire.

Lead is one of the metals which is most quickly converted by heat into an oxyde, which is easily melted into a semi-vitrified, and powerful vitrifying matter, called litharge. By increasing the proportion of imperfect metals, it prevents them from being so well covered and protected by the perfect metals; and by uniting with these imperfect metals, it communicates to them its property of being very easily oxydated. By its vitrifying and fusing property, which it exercises with all its force upon the calcined and naturally refractory parts of the other metals, it facilitates and accelerates the fusion, scorification, and separation of these metals. The lead, which in this operation is scorified, and scorifies along with it the imperfect metals, separates from the metallic mass, with which it is then incapable of remaining united. It floats upon the surface of the melted mass, and becomes semi-vitrified. But the litharge so produced would soon cover the melted metal, and by preventing the access of air, would prevent the oxydation of the remaining imperfect metals. To remedy this, such vessels are employed as are capable of imbibing and absorbing in their pores the melted litharge, and thus remove it out of the way. Or, for large quantities, vessels are so constructed, that the fused litharge, besides being soaked in, may also drain off through a channel made in the corner of the vessel.

Experience has shewn, that, for this purpose, vessels made

of lixiviated wood or bone ashes are most proper. These vessels are called *cupels*, and this process is called *cupellation*. The cupels are flat and shallow. The furnace ought to be vaulted, that the heat may be reverberated upon the surface of the metal during the whole time of the operation. Upon this surface a crust or dark coloured pellicle is continually forming. In the instant when all the imperfect metal is destroyed, and consequently the scorification ceases, the surface of the perfect metal is seen, and appears clean and brilliant. This forms a kind of fulguration, or corruscation, called lightning. By this mark, the metal is known to be refined.

Purification of gold by antimony. When gold contains only a small quantity of alloy, it may be separated from them by melting it in a crucible that will hold twice its quantity at least, and throwing upon it, whilst in fusion, twice its weight of crude antimony (sulphuret of antimony). The crucible is then to be covered, and the whole is to be kept in a melting state for some minutes; and when the surface sparkles, it is quickly to be poured into an inverted cone, which has been previously heated and greased. By striking the cone on the ground, the metal will come out when cold. The compact mass consists of two substances; the upper part is the sulphur of the crude antimony, united with the impure alloy; and the lower part is the gold, united to some of the regulus of antimony, proportionable to the quantities of metals which have been separated from the gold, which are now united with the sulphur of the antimony. This regulus of gold may be separated from the regulus of antimony by simple exposure to less heat than will melt the gold, because antimony is volatile in such a heat, and is then dissipated. If the gold is not sufficiently purified by this first process (which is often the case,) it must be repeated a second, and even a third time. When a part is dissipated, more heat is required to keep the gold in fusion; therefore the fire must be increased towards the end of the operation. The purification is completed by means of a little nitre thrown into the crucible, which effectually calcines the remaining regulus of antimony. Sometimes, after these operations, the gold is found to be deprived of much of its usual ductility; this however is easily restored to it, by fusing it with nitre and borax. The first part of this process is founded on a property of sulphur, by which it is incapable of uniting with gold, and is strongly disposed to unite with all other metallic substances, excepting platina and zinc; and also upon the property of sulphur, that it has less affinity with regulus of antimony than with any metallic substance with which it can unite. Hence, when gold, alloyed with silver, copper, iron, lead, &c. is fused together with sulphuret of antimony, these latter metals unite with the sul-

phur of the antimony, while the reguline part, disengaged from them by its sulphur, unites with the gold.

The sulphur of the antimony, though it unites with the baser metals, does not destroy them, but forms with them a scoria, from which they may be separated by treatment as an ore.

Parting.

When the quantity of silver united to the gold is considerable, they may be separated by other processes. Nitric acid, muriatic acid, and sulphur, which cannot dissolve gold, attack silver very easily; and therefore these three agents furnish methods of separating silver from gold, which operation is called *parting*.

Parting by nitric acid is the most convenient, and therefore most used, and is even almost the only one employed by goldsmiths and coiners. Wherefore it is called simply, *parting*. That made with muriatic acid is only made by cementation, and is known by the name of *concentrated parting*. Lastly, parting by sulphur is made by fusion, and is therefore called *dry parting*.

Parting gold from silver by nitric acid or aqua fortis. Although parting by nitric acid be easy, it cannot succeed, or be very exact, unless we attend to some essential circumstances. The gold and silver must be in a proper proportion; for if the gold be in too great a quantity, the silver would be covered and guarded by it from the action of the acid; therefore, when assayers do not know the proportion of gold to silver in the mass, they rub the mass upon a *touch-stone* (which is usually composed of black basaltes, though black pottery will do very well,) so as to leave a mark upon it; they then make similar marks with the *proof-needles* (which are needles composed of gold and silver alloyed together in graduated proportions,) and by comparing the colour of the several marks, they discover the probable scale of admixture.

If the trial shews, that in any given mass the silver is not to the gold as three to one, this mass is improper for the operation of parting by aqua fortis. In this case, the quantity of silver necessary to make any alloy of that proportion, must be added. This operation is called *quartation*, because it reduces the gold to a fourth of the whole mass. No inconvenience arises from too great quantity of silver, except a waste of aqua fortis. The nitric acid or aqua fortis employed, must be very pure, and especially free from mixture of sulphuric and muriatic acids. Its purity must therefore be ascertained; and if this be found not sufficient, the acid must be purified by nitrate of silver.

If the purity of the nitric acid were not attended to, a quantity of silver proportionable to these two foreign acids, would

be separated during the solution; and this portion of silver converted by these acids to sulphrate of silver, and to muriatic of silver, would remain mingled with the gold.

When the metallic mass is properly alloyed, it is to be reduced to plates rolled up spirally, called *cornets*, or to grains. These are to be put into a matrass, and upon them a quantity of aqua fortis is to be poured, the weight of which is to that of the silver as three to two; and as the nitric acid employed for this operation is rather weak, the solution is assisted, especially at first, by the heat of a sand-bath, in which the matrass is to be placed. When, notwithstanding the heat, no further mark of solution appears, the aqua fortis charged with silver is to be decanted. Fresh nitric acid is to be poured into the matrass, stronger than the former, and in less quantity, which must be boiled in the remaining mass, and decanted as the former. Aqua fortis must even be boiled a third time on the remaining gold, that all the silver be certainly dissolved. The gold is then to be washed with boiling water. This gold is very pure, if the operation has been performed with due attention. It is called gold of parting.

The silver dissolved in the aqua fortis, may be separated either by distillation—in which case all the aqua fortis is recovered very pure, and fit for another parting—or it may be precipitated by some substance which has a greater affinity than this metal with nitric acid. Copper is generally employed for this purpose in the mint.

The solution of silver is put into copper vessels. The aqua fortis dissolves the copper, and the silver precipitates. When the silver is all precipitated, the new solution is decanted, which is then a solution of copper. The precipitate is to be well washed, and may be melted into an ingot. It is called parted silver. When this silver has been obtained from a mass which had been refined by lead, and when it has been well washed from the solution of copper, it is very pure. Or the silver may be separated from the nitric acid by adding to it muriatic acid, with which it forms muriate of silver. Muriate of silver may be de-composed by mixing it with soda, and exposing it to a sufficient heat in a crucible, whereby the soda unites to the muriatic acid, and sets the silver free.

The refiners frequently employ this solution of copper obtained in the process of parting, for making *verditer;* which is prepared by adding quick-lime to the solution; a precipitate takes place, which is the blue pigment, known by the name of verditer

Parting gold from silver by cementation. This is also called parting by concentration, and is usually employed when the quantity of gold is so great to that of the silver, as to render it a difficult task by aqua fortis. The mixed metal to be ce-

mented is to be reduced to plates, as thin as small pieces of money. At the bottom of the crucible, or melting-pot, is to be laid a stratum of cement, composed of four parts of bricks powdered and sifted, one part of green copperas (sulphate of iron) calcined to redness, and one part of common salt, about the thickness of a finger in depth. Upon this stratum a layer of plates of the metal is to be placed, and then another stratum of cement, and so on till the crucible is filled. It is now to be placed in a furnace, or oven (after a top has been luted on the crucible,) and exposed for twenty-four hours, till it is gradually made red hot, but by no means to be melted. The fire is now left to go out, and the metal is permitted to cool, that it may be separated from the cement, and boiled repeatedly in large quantities of pure water. This gold is afterwards to be tried on a touch-stone; and if it is not sufficiently purified, the process must be performed a second time. By the above method, we see how powerfully silver is dissolved by marine acid, when it is in a state of subtile vapour, which is disengaged from the common salt of the cement. Instead of common salt, nitre may be used, as the nitrous acid readily dissolves silver; but the mixture of common salt and nitre together is highly injudicious, because the joint acids are able to dissolve some of the gold with the silver. Whatever silver has been separated, will now remain in the cement; but it may be freed from this by lead, in the method described in cupellation.

Parting gold from silver in the dry way. This is also called *parting by fusion*, and is performed by means of sulphur, which has the property of uniting easily with silver, while it does not attack gold. This dry parting is troublesome, and even expensive, and ought not to be undertaken but when the silver far exceeds the gold, because sulphur will not separate it so easily as aqua fortis, and will therefore require a further application to cupellation and solution.

289. *How to renew old writings almost defaced.*

We ordered, in article 225, p. 72, to boil gall-nuts in wine; but we must add here that it is far preferable to infuse them only twenty-four hours in it, then put all in a retort and distil. The liquor which comes from it being passed on the paper or parchment, will revive the defaced parts of the writings.

290. *To write in gold letters, on iron or steel.*

1. Pound some gold marcasites in a mortar; put it to infuse twenty-four hours in vinegar, and boil it gently over the fire in a glazed pipkin, till the vinegar is almost vanished

away, which will take you nearly a whole day's time to boil. Then take the composition off from the fire, and after having left it to cool and dry a little more in the shade, put it in a retort, and distil.

2. With this liquor, write on iron and steel; the letters will appear black at first: but if, when dry, you rub over them with a piece of linen, they will turn gold colour.

291. *An ink which writes like silver, without silver in it.*

1. Amalgamate equal parts of pewter and quick silver, in the same manner as goldsmiths do; grind well that amalgamation on the stone.

2. If you dilute of this powder in gum-arabic water, and write with it, your letters will appear like silver.

292. *To write on silver in black which will never go off.*

Take burnt lead, and pulverise it. Incorporate it next with sulphur and vinegar, to the consistence of a painting colour, and write with it on any silver plate. Let it dry, then present it to the fire so as to heat a little the work, and all is done.

293. *To change red wine into white, and white into red.*

If you want to make red your white wine, throw into the cask a bag of black vine-wood ashes; and to whiten the red wine, you must put a bag of white vine-wood ashes. Forty days after, take out the bag, shake the cask, and let it settle again; then you will see the effect.

294. *To prevent wine from* fusting, *otherwise tasting of the cask, and to give it both a taste and flavour quite agreeable.*

Stick a lemon with cloves as thick as it can hold; hang it by the bung-hole in a bag over the wine in the cask for three or four days, and stop it very carefully for fear of its turning dead, if it should get air.

295. *To make a sweet wine of a very agreeable flavour, and besides very wholesome.*

Gather the grapes, and expose them for three whole days in the sun. On the fourth day at noon, put them under the press, and receive the first drop which runs of itself before pressing. When this virgin drop shall have boiled, or fermented, put to every fifty quarts of it one ounce of Floren-

tine orrice in subtile powder. A few days after take it out clear from its lye, and then bottle it.

296. *To give wine a most agreeable flavour.*

Take a pailful of *mout*, which boil and evaporate to the consistence of honey. Then mix with it an ounce of Florentine orrice, cut in small bits, and one drachm of *costus*. Put all into a bag, and let it down in the cask by the bung-hole, after having previously drawn out a sufficient quantity of wine to prevent the bag from coming at it. This bag being thus suspended by a string, which will hang out of the bung hole, stop it well and there will drop from the bag into the wine a liquor which will give it a most agreeable taste.

297. *How to find out whether or not there be water mixed in a cask of wine.*

Throw in the cask one wild pear or apple. If either of these fruits swim, it is a proof there is no water in the wine; for if there be any, it will sink.

298. *To separate water from wine.*

Put into the cask a wick of cotton, which should soak in the wine by one end, and come out of the cask at the bung hole by the other; and every drop of water which may happen to be mixed with the wine, will still out by that wick or filter.

You may also put some of this wine into a cup made of ivy wood, and then the water will perspire through the pores of the cup, and the wine remain.

299. *To restore a wine.*

Put in the cask one pound of Paris plaister. Then make a piece of steel red hot in the fire; and by means of a wire fixed to one of its ends, introduce it by the bunghole into the wine. Repeat this operation for five or six days running, as many times each day. Then, finally, throw into the wine a stick of brimstone tied in a bag, which you take off two days after; and the wine will be perfectly well restored.

300. *To correct a bad taste and sourness in wine.*

Put in a bag a root of wild horse radish cut in bits. Let it down in the wine, and leave it there two days; take this out, and put another, repeating the same till the wine is perfectly restored.

301. *To cure those who are too much addicted to drinking wine.*

Put in a sufficient quantity of wine, three or four large eels, which leave there till quite dead. Give that wine to drink to the persons you want to reform, and they will be so much disgusted of wine, that though they formerly made much use of it, they will now have quite an aversion to it.

302. *To prevent one from getting intoxicated with drinking.*

Take white cabbages, and four pomegranate juices, two ounces of each, with one of vinegar. Boil all together for some time, to the consistence of a syrup. Take one ounce of this before you are going to drink, and drink afterwards as much as you please.

303. *A method of making people drunk, without endangering their health.*

Infuse some aloe wood, which comes from India, in a glass of wine, and give it to drink. The person who drinks it will soon give signs of his intoxication.

304. *To recover a person from intoxication.*

Make such a person drink a glass of vinegar, or some cabbage juice, otherwise give him some honey. You may likewise meet with success, by giving the patient a glass of wine quite warm to drink, or a dish of strong coffee, without milk or sugar, adding to it a large teaspoon full of salt.

305. *To prevent the breath from smelling of wine.*

Chew a root of *iris troglotida*, and no one can discover by your breath whether you have been drinking wine or not.

306. *To preserve good wine to the last.*

Take a pint of the best spirit of wine, and put in it the bulk of your two fists of the second peel of the alder tree, which is green. After it has infused three days strain the liquor through a cloth, and pour it into a hogshead of wine. That wine will keep good for ten years, if you want it.

307. *To make good wine vinegar in a short time.*

Throw some *Taxus* wood, or yew-treee, in any wine, and it will not be long before it turns into vinegar.

308. *To make very good and strong vinegar with the worst of wines.*

Grind into subtile powder five pounds of crude tartar.—Pour on it one pound of oil of vitriol. Wrap up the whole in a bag, tie it and hang it by the bung-hole, in a cask of bad and totally spoiled wine. Move and stir now and then that bag in the wine, and it will turn into very good vinegar.

309. *To turn wine into vinegar in less than three hours.*

Put in the wine a red beet, and it will be quite sour and true vinegar, in less than three hours.

310. *To restore such a wine to its first taste.*

Take off the red beet, and in its stead put a cabbage root into that wine, and it will return to its primary taste, in the same space of time.

311. *An excellent preparation of vinegar.*

1. Take white cinnamon, long pepper, and *cyprus*, of each an ounce; round pepper, half an ounce, and two nutmegs. Pulverise each drug separately, and put them in so many distinct bags. Put them in six different and separate quarts of the best vinegar, and boil them two or three minutes.

2. Then boil separately six quarts of good wine.

3. Season a cask, which is done by pouring a quart of the best vinegar into it, with which you rinse it. Then pour in your boiled wine and vinegars, and fill half way the cask, with the worst and most spoiled wine. Stop the cask, and keep it till the vinegar is done. Then draw from it, and refill the cask with the same quantity of bad wine, as you take of vinegar.

312. *To render vinegra alkali.*

Saturate any quantity of vinegar with salt of tartar.

313. *To make in one hour, good rose vinegar.*

Put a drachm of hare's marrow in a pint of wine, and you will see the consequence.

314. *Another method to make such vinegar in an instant.*

1. Take common roses, and unripe blackberries, which grow in hedges, of each four ounces, and of barberry fruits one. Dry them all in the shade, and reduce them into subtile powder.

2. Mix two drachms of this powder into a glass of white or red wine. Then let it settle to the bottom, and strain it through a cloth. It will be a very fine vinegar.

315. *To operate the same in one hour's time, on a larger quantity of wine.*

1. Take the best rye-flour, which dilute in the strongest vinegar, and make a thin round cake with it. Bake it quite dry in the oven; then pound it into a very fine powder, with which and vinegar, make again another cake as before, and bake it like the first. Reiterate this operation three or four times.

2. If you hang the last made cake in a cask of wine quite hot, you will turn the whole into vinegar in less than an hour.

316. *The receipt of the vinegar, called the* Grand Constable's Vinegar.

Take one pound of damask raisins, and cure them of their stones. Put these raisins in a glazed jar, with two quarts of good rose vinegar. Let all infuse for one night over hot ashes, then boil it the next morning four or five minutes only. Take it off the fire and let it cool, strain it through a cloth, and bottle it to keep for use, afterwards cork the bottle.

317. *A secret to increase the strength and sharpness of the vinegar.*

Boil two quarts of good vinegar to the evaporation of one; then put it in a vessel, and set it in the sun for a week. Now if you mix this vinegar among six times as large a quantity of bad vinegar in a small cask, it will not only mend it, but make it very strong and agreeable.

318. *The secret for making good vinegar, given by a vinegar-man at* Paris.

1. Pound coarsely, or rather bruise only, one ounce of long pepper, as much in ginger and the same quantity of *pyrethra*. Put these in a pan over the fire with six quarts of wine. Heat this only to whiteness, then put it in a small cask, and set it in the sun, or over a baker's oven, or any other warm place.

2. Now and then add new wine in your cask, after having previously heated it as before, and let that quantity be no more than two or three quarts at a time, till the cask is quite full. If you add a few quarts of real vinegar, it will be the

stronger. Before casking the wine, let it rest in the pan in in which it has boiled for two or three days. A glazed earthen pan is preferable to a copper one for boiling the wine in; for during the three days infusion, the copper might communicate a dangerous quality of verdigrease to the vinegar.—When you put vinegar to meliorate this composition, instead of wine, you must take care to heat it over the fire, but not so much as the wine. Let the cask be well rinsed and perfectly clean, before putting the vinegar in.

3. The wild blackberries which grow in hedges are very good to make vinegar, but they must be used while red; then put them in the wine, heat this to whiteness, and proceed in the same manner as you do with *pyrethra*, ginger, and long pepper The dose of blackberries is not determined; you may take any discretionable quantity of them, and the vinegar which results from these is very good.

319. *To make vinegar with water.*

Put thirty or forty pounds of wild pears in a large tub, where you leave them for three days to ferment, then pour some water over them, and repeat this every day for a month. At the end of which it will make a very good vinegar.

320. *To make good vinegar with spoiled wine.*

Put a large kettle full of spoiled wine on the fire; boil and skim it. When wasted of a third put it in a cask, wherein there is some very good vinegar. Add a few handfuls of chervil over it in the cask, and stop the vessel perfectly close. You will have very good vinegar in a very short time.

321. *A dry portable vinegar, or the* vinaigre en poudre.

Wash well half a pound of white tartar with warm water, then dry it, and pulverise it as fine as possible. Soak that powder, with good sharp vinegar, and dry it before the fire, or in the sun. Resoak it again as before with vinegar, and dry as above, repeating this operation a dozen times. By these means you shall have a very good and sharp powder, which turns water itself instantly into vinegar. It is very convenient to carry in the pocket, especially when travelling.

322. *To make a* rossolis *which may serve as a foundation to other liquors.*

Put three quarts of brandy, and one of water in a glazed earthen pot. Place this pot on a charcoal fire, adding a crust of bread and one ounce of anniseed, and cover it till it boils.

Then uncover it and let it boil five minutes, and put in a pound of sugar, or more if you chuse. Now beat the white of an egg with a little of your liquor, take the pot off the fire, and throw in the white of an egg. Let this thus rest for three days.

323. *To make Raspberry, Strawberry, Cherry, or other such waters.*

1. Take the ripest raspberries, strain them through a linen cloth to express all the juice out of them. Put this in a glass bottle uncorcked, and set it in the sun, in a stove, or before the fire till cleared down. Then decant it gently into another bottle, without disturbing the *fæces* which are at the bottom.

2. To half a pint of this juice, put a quart of common water, and a quarter of a pound of sugar. Beat all together, by pouring backwards and forwards, from one vessel into another, strain it through a linen cloth, and set it to cool in a pail of ice. It is a fine cooling draught in the summer.

3. Strawberries, cherries, &c. are done in the same manner.

324. *Lemonade water at a cheap rate.*

Dissolve half a pound of sugar in a quart of water; rasp over it the yellow part of one, two, or three lemons, as you like, and mix a few drops of essential oil of sulphur in the liquor. Then cut three or four slices of lemon in the bowl, when you put the liquor in it.

325. *Apricot water.*

Take a dozen of apricots, very ripe. Peel and stone them. Boil a quart of water, then take it off from the fire and throw in your apricots. Half an hour after put in a quarter of a pound of lump sugar, which being dissolved, strain all through a cloth, and put it to cool in ice as the others.

326. *To make exceeding good Lemonade.*

On a quart of water put the juice of three lemons, or two only if they be very juicy. Add seven or eight zests of them besides, with one quarter of a pound of sugar. When the sugar is dissolved, strain the liquor, and cool it in ice as before mentioned.

327. *To make a cooling Cinnamon Water.*

Boil one quart of water in a glass vessel before the fire.—Take it off, and put in two or three cloves, and about half an ounce of whole cinnamon. Stop well the bottle, and when

the water is cold, put half a pint only of it in two quarts of water with sugar to your palate, a quarter of a pound is the proper quantity. Then cool it as usual, in ice before serving.

328. *Anniseed Water.*

The anniseed water is made in the same manner as the coriander water.

329. *Juniper Water.*

Put two pounds of juniper berries with two quarts of brandy in a stone bottle, which stop well and place on hot ashes to infuse for twenty-four hours. Strain the liquor, and add one pound of sugar, half an ounce of cinnamon, as much cloves, a preserved half peel of a lemon, and two pugils of anniseed. Put these in the bottle, stop it well, and place it at two or three different times in a baker's oven, after the bread is out, and when you may bear your hand in it without burning.

330. *To make good Hydromel, otherwise Metheglin.*

Take honey and water, equal quantities in weight. Boil them together and skim the honey. When done sufficiently you may know by putting an egg in, which must swim at top. Pour then the liquor in a cask where there has been spirit of wine, or good brandy, well soaked with either, and still wet with the spirit, and add two or three grains of ambergris.—Stop well the cask, and set it in the sun during the dog days. When it begins to ferment, unstop the cask to let the scum out, which arises like that of new wine. During that time you must not stir the cask. When the first fire of the fermentation has subsided, stop the cask again, and the hydromel is fit for keeping.

Note. Instead of the sun, you may in other seasons, make use of the top of a baker's oven, a stove, or a hot-house.

331. *Angelic water.*

1. Take half an ounce of angelica, as much cinnamon, a quarter part of cloves, the same quantity of mace, of coriander, and of green anniseed, with half an ounce of cedar-wood. Bruise all these ingredients in a mortar, and set them to infuse for twelve hours, with two quarts of genuine brandy, in a matrass or retort. Then distil the liquor by *balneum mariæ*.

2. Two or three ounces only of this essential spirit in two quarts of brandy, with the addition of a very small quantity of musk and ambergris, will make a very agreeable liquor.

332. *To make Cinnamon Water.*

In three quarts of once boiled water, and then cooled again, put half a pint of essential spirit of cinnamon, distilled like that of anniseed. Add three pints of spirit of wine, and one of clarified sugar. Strain all through the jelly-bag, *&c. &c.*

333. *The preparation of musk and amber, to have it ready when wanted to put in cordials.*

Put in a mortar and pulverise four grains of amber, two of musk, and two ounces of sugar. Wrap this powder up in a paper, and cover it over with several others. With this powder you may perfume such cordials as require it. The dose is a pugil, taken with the point of a knife, shake lightly in it. You may however increase or diminish this dose, according to your liking.

334. *Strong anise-seed water, or animated brandy.*

Put half a pint of essential spirit of anise-seed into three quarts of the best genuine brandy, with one of boiled water. If you want it sweet, add clarified sugar. Strain all through the jelly-bag, *&c. &c.*

335. *An exceeding good* Ratafia.

On a quart of good brandy put half a pint of cherry juice, as much of currants, and the same of raspberries. Add a few cloves, a pugil of white pepper in grain, two of green coriander, and a stick or two of cinnamon. Then pound the stones of the cherries, and put them in, wood and altogether. Add a few kernels of apricots, thirty or forty are sufficient. Stop well the pitcher, which must be a new one, after all these ingredients are in, let the whole infuse a couple of months in the shade, shaking twice or thrice during that space of time, at the end of which run the liquor through the flannel bag, and next through the filtering paper, then bottle and stop it well for use.

Note. In increasing in due proportion the quantity of the brandy, and the doses of each of the ingredients prescribed, you may make what quantity you like of this *Ratifia.*

336. *An essence of ambergris.*

Pound one drachm of ambergris, and put it on a pint of good spirit of wine, in a thick and green glass bottle. Add to it half a drachm of musk in bladder, cut very small. Set this bottle in the full south sun, on gravel, during the dog-days, taking it off every night, and during rainy weather. Stir and

shake well the bottle and its contents, two or three times a day, when the sun strikes on the bottle, that the amber may diffuse in the liquor, and the essence is made. Decant, bottle, and stop it for use.

337. *A smelling water.*

1. Put in any quantity of brandy, benjamin, and storax calamite, equal parts; a little cloves and mace, coarsely bruised. Set this a digesting for five or six days on warm ashes. When the liquor is tinged of a fine red, decant it gently from the residue in a glass bottle, and throw in a few grains of musk, before stopping it.

2. Three drops of this smelling water in a common glass tumbler of water, give it a very agreeable fragrance.

3. With the ground, or residue, you may make lozenges, by adding a little gum-adragrant to bind them.

338. *A receipt to compose* one pint *of* rossolis, *with which you can make forty.*

1. Take two ounces of galanga; half a one of cinnamon; as much cloves; one of coriander; a penny-worth of green anise-seed; half an ounce of ginger; two drachms of mace, and two of Florentine orrice. Bruise all, and put it to infuse with three pints of the best brandy, in a matrass with a long neck. Adapt it to the receiver, and lute well all the joints, both of the receiver, and the bolthead, with paper and starch.

2. Twelve hours after it has been a digesting, distil the liquor by the heat of a very gentle *balneum mariæ*, till you have got about one quart of distilled spirit. Then unlute the receiver and keep the liquor.

3. You may adapt another receiver, or the same again, after being emptied, lute it, and continue to distil as before. But what will come will be infinitely weaker, though perhaps not altogether very indifferent.

339. *Burnt wine.*

Put a quart of good *Burgundy* in an open pan, with a pound of sugar, two leaves of mace, a little long pepper, a dozen of cloves, two or three tops of rosemary branches, and two bay-leaves. Place that in the middle of a wheel-fire of blasting charcoal. When the wine begins to be hot, set the fire to it with a bit of paper, and thus let it kindle and blaze till it goes out of itself. This wine is drank quite hot, and it is an admirable drink, especially when the weather is very cold.

340. *An admirable oil of sugar.*

Rinse a matrass with vinegar, put in it some dry powder sugar, or lump sugar pulverised. Keep that matrass on hot ashes, turning and whirling it round and flat ways, by means of the neck of the matrass which you hold in your hands with a cloth, and stop it not. The effect is such, the heat occasions the vapours to rise about the matrass, which by turning and whirling it, as above-mentioned, makes the sugar which is in it resoak and imbibe them again. This operation dissolves the sugar, and reduces it into a sort of oil.

341. *Another oil of sugar, without the assistance of fire.*

Take a lemon, which hollow and carve out inwardly, taking out all the pulp as skilfully as possible. Then fill it up with sugar candy in powder, and suspend it in a very damp cellar, with a bason under it. There will drop an exceeding good oil, which is endowed with the most admirable qualities for consumptive people, or them who are affected with a difficulty of breathing.

Note. A little of that oil in liquors gives to any one of them, to which it is added, a very fine flavour.

342. *An admirable essence of red sugar.*

1. Pulverise five pounds of the best double refined, or royal sugar; which done, put along with eight ounces of brandy in a large matrass, over a sand bath. Distil some part of this first, on a slow fire, to avoid burning the sugar. Re-put the distilled liquor over the sugar again in the matrass. Continue to distil and pour the liquor again in the matrass over the sugar, till the sugar becomes red, which will happen at the seventh or eighth iteration of distillation.

2. Now distil out all the brandy, and on the remaining sugar pour common water, which distil also, then add some more, continuing so to do, till you have drawn out all the tincture of the red sugar.

3. Take next all these red waters, and run them through the filtering paper, then distil the phlegm on a gentle fire to siccity (or dryness). Put again this distilled phlegm on the residue: which place all together in a cold cellar. You will find some red chrystals, which pick up, and when dry, pulverise; then pour brandy over to dissolve. This admirable quintessence of sugar has the virtue of preserving the radical moistness of the inside, and our health.

342. *How to extract the essential oil from any flower.*

Take any flower you like, which stratify with common sea salt in a clean earthen glazed pot. When thus filled to the top, cover it well, and carry it to the cellar. Forty days after put a crape over a pan, and empty all on it to strain the essence from the flowers by pressure. Bottle that essence, and expose it four or five weeks in the sun, and dew of the evening to purify. One single drop of that essence is enough to scent a whole quart of liquor.

344. *Essence of jessamine, roses, and other flowers.*

1. Take roses of a good colour, and fresh gathered. Pick all the leaves, which expand in the shade on a paper. For two or three days, during which you are to leave them there, asperse them, morning and evening, with rose water, stirring them each time.

2. When this has been performed, put them in a glass, or varnished vessel, which stop as perfectly as you can, and place in the hottest horse-dung, which renew every five days. A fortnight after this, place the vessel in a *balneo mariæ*, adapting a bolt-head to it and a receiver, and lute all well. Distil the water, on which you observe the essence swimming. This you must divide by means of a wick, or filtering paper. Put the essence in a glass phial well stopped.

345. *To draw the essential oil of roses.*

Pound in a mortar thirty pounds of leaves of roses, with three pounds of common decrepitated salt; then put all in a pot well luted, which set in a cool place. Fifteen or eighteen days after, moisten well this matter with common water, stirring it till reduced into a pap. Then put it in an alembic with its refrigerator. Make a smart fire, which will send first the water, next the oil, susceptible of congealing by cold, and liquifying again by heat. One drop of that oil gives more smell a hundred times than the distilled water from the same roses.

346. *Essence of* capon *and other* fowls.

Cure the inside of any fowl, by taking away all the entrails. Fill it with lump sugar, pulverised and mixed with four ounces of damask raisins, perfectly stoned. Sew the fowl up again, and put it in a pipkin, which cover carefully with its lid, and lute all round with paste. Place this pot in an oven, when the bread goes in, and take it out along with it. Then uncover it, and strain the liquor through a cloth, with expression of the animal. This essence is the greatest restor-

ative for old or enervated people; likewise to hasten the recovery of health after long illness. Take two large table spoonfuls early in the morning fasting, and as much at night after supper.

347. *Virginal milk.*

1. Take one ounce and a half of benjamin; storax as much, and one of eastern white balm. Put all in a thick glass phial, with three half pints of spirit of wine, which pour over. Put this in digestion over hot ashes, till the spirit of wine appears of a fine red colour.

2. To use it, put four drops in half a pint of water, and it instantly turns as white as milk.

3. Exteriorly used, it whitens the skin, if you wash with it; it has likewise the same effect upon teeth, by rinsing the mouth, and rubbing them with it. Interiorly taken, it cures the heats and burning of the extinction of the voice.

348. *To make mutton-suet candles, in imitation of wax candles.*

1. Throw quick-lime in melted mutton suet; the lime will fall to the bottom, and carry along with it all the nastiness of the suet, so as to leave it as pure and fine as wax itself.

2. Now if with one part of that suet, you mix three of real wax, you will never be able to find out the mixture, not even in the moulding and casting wax for figures or ornaments.

349. *To make soap.*

The white, or as it is called, the *Geno* soap, is made with wood ashes, *Alicant* kali, lime and olive oil. The black is made of the same materials, with this exception, that it is made with the *fæces* and tartar of the oils. The marble is made with *Alicant* kali, *bourde*, and lime; and when it is almost done, they take some red earth, which they call cinnabar, with copperas; they boil these together and throw it in the copper where the soap is. It occasions a blue marbling, as long as the copperas keeps the better of the two ingredients; but as soon as the cinnabar has at last absorbed the vitriol, this blue hue subsides intirely, and the red alone predominates. Therefore to form the soap, make different lyes with all these sorts of matters, and when they are sufficiently charged (which beginners know by their carrying an egg swimming, without its sinking to the bottom, and experienced soap-boilers are judges of by dejustation, and the time they have been at work) they put all these lyes in proper coppers, and pour at the same time in *Provence* and *Languedoc*, oil of

olive; in *Germany*, grease; and in *England*, oil of fish. Then boil all together with a great blasting fire; and eighteen or twenty days afterwards these oils have so well aspired all the salts of the lye, that this is left quite flat and untasty. Then by the cocks which are at the bottom of the coppers, the water or lye is let out and the lump of soap taken out and placed to dry in houses built on purpose, to make it take a sufficient consistence.

350. *To prevent any thing burning in the fire.*

Pound into powder cherry-tree gum and alum in equal quantities, and imbibe that powder with strong wine-vinegar, which leave thus a digesting on warm ashes, for the space of twenty-four hours. If with this composition you rub any thing and throw it in the fire, it will not be consumed by it.

351. *To prevent burning one's fingers in melted lead.*

Take two ounces of *bol armenian*, one of quicksilver, half a one of camphire, and two of brandy. Mix all together with a pestle in a brass mortar, and rub your hands with this composition, before steeping them into a pot of melted lead, and this will have no effect upon them.

352. *A fire which cannot be extinguished by water.*

Take five ounces of gun-powder; saltpetre three; brimstone, two, camphire, rosin, and turpentine one of each. Mix all together, and imbibe it with rectified oil of rosiny fir-tree. If you fill balls with this composition and throw them thirty feet deep in the water, they will burn still, even if you cover them intirely with mould.

353. *To kill all sorts of worms in cattle.*

Take *saven*, chop it small, and beat it with fresh butter, make it in small balls, and give it to the beast in a proportionable quantity. Sweet wort and a little black soap mixed together as a drink, maketh all sorts of beasts void the worms.

354. *To kill maggots in sheep.*

Take goose grease, tar and brimstone, mix them together on the fire, and when cold anoint the troubled places therewith.

355. *How to colour any sort of liquor.*

Bruise into a coarse powder some *santalum rubrum*, which put into a bottle with a discretionable quantity of spirit of

wine poured over it. In five or six hours time the tincture will be very high; therefore it will be fit to give a colour to any liquor you chuse, by pouring some of it into the liquor, and shaking it till you find it is coloured to your liking.

356. *A ladies fine* rouge *not hurtful to their skin like other* rouges, *wherein there always enters a mixture of lead or quicksilver.*

The above preparation of *santalum rubrum*, modified with common water to take off the strength of the spirit of wine and an addition of one clove, a little civet, a little cinnamon, and the bulk of a filbert of alum, *per* quarter of a pint of liquor, with safety.

357. *A fine smelling water, at a small expense.*

Take two quarts of rose-water drawn by distillation in *balneo mariæ*, which put in a large bottle filled with fresh rose leaves. Stop this bottle well with a cork and wax, then expose it to the sun, for a month, or six weeks: afterwards decant the liquor into another bottle, in which, for every one quart of liquor, add two grains weight of oriental musk, and cork it well. This water is of a charming fragrancy, and lasts a great while. It communicates the odour to them you touch after having rubbed your hands with it.

358. *To make an imitation of coffee.*

1. Take any quantity of horse beans, which put into a pan to roast over the fire till they begin to blacken. Then take a little honey with the point of a knife and put it among the beans, turning them well with it, till soaked in the beans, repeating the same process till they are of a deep brown chesnut colour. Now take them from the fire, and while they are quite burning hot, put for every large handful of beans, half an ounce of *casi mundata*, with which imbibe them well by stirring and shaking in the pan as much as you can, and they are done.

2. These grind in the mill and make coffee of, it will have the same taste and flavour as the true Moca- coffee, so as not to be distinguished from it by the greatest connoisseurs.

Note. This coffee may be drank either thick or clear, with sugar as usual.

359. *Directions for preparing the true coffee.*

1. True coffee must be roasted in an iron pan, or in a glazed earthen pan, over a clear charcoal fire without flames.—

Turn it with a stick while it is on the fire, to make each grain roast more regularly and equally. It is well roasted when it is all of a dark brown.

2. There is a much better method of roasting it, by means of a certain iron drum made in the form of a ladies muff-box, with a handle at one end, an iron peg at the other, and a latch door in the middle. By this door you introduce the coffee, which you fasten in by means of the latch. Then propping it on the top of a chaffingdish made on purpose, in which there is a charcoal fire, you roast the coffee by turning the drum over it with the abovementioned handle; and thus the coffee roasts in the most regular manner.

3. When the coffee is roasted, grind it, keep it closely confined in leaden boxes, with a screwing lid. However, it is still much preferable to grind no more at a time than what one wants to use at once.

4. The liquor is made by putting one ounce of that powder to three quarters of a pint of boiling water to make three full dishes. And, after an infusion of ten minutes, during which it is kept boiling, the coffee is fit for drinking.

360. *A receipt for making chocolate.*

1. Dissolve in a copper pan some pulverised royal lump sugar, with a little orange water. When the sugar is turned into a syrup throw in the cocoa, the vanelloe, the cinnamon. Mexican-pepper, and cloves, all, and every one of which, ought to have been first reduced into an impalpable powder. Stir all well while it boils; and when you judge it to be sufficiently done, pour the paste on a very smooth and polished table, that you may roll it, and give it whatever form and shape you like.

2. To prepare it with either milk or water, in which, when boiling hot, you first dissolve it, then, with a box-mill, with a long handle, you mill it to froth in the pot in which it is making, and pour it afterwards in cups to drink.

361. *Preserved nuts.*

1. Gather the nuts, before the woody shell begins to harden under the green rind. Cut open and throw off that green rind; and throw immediately the nut into a pail of cold water, to prevent its blackening. Boil them four or five minutes, and throw the first first water away because it is bitter. Put fresh water, which boil again, and throw away as the first, and repeat this operation a third and fourth time, if required, to take off all the bitterness of the nuts.

2. After they have boiled in their last water, take them out, and throw them into cold water, for fear they should

turn black still. From this water change them again into another, in which put them one by one, as you take them from the first, and pressing them between your fingers to purge them from all the bitter water they might still contain.

3. Now make a syrup as usual, in which boil some lemon peels for the sake of fragrancy only, taking them all out after a few minutes of their being in, then put the nuts in their stead, which leave to boil in the syrup as long as you think proper.

362. *How to make syrups with all sorts of flowers, which shall be possessed of all their taste, flavour and fragrancy.*

Heat in a pan about half a pint of water, then put in it sugar in the proportion to the quantity of flowers you may have; boil, skim and thicken it to a proper consistence.—When done, put your flowers in a glazed vessel, and cover it over with linen, through which pouring pouring the syrup. you strain this upon the flowers. These being thereby quite deadened, put all together again in the same piece of linen, and strain it again in another vessel, squeezing well the flowers. Then bottle this syrup, and keep it for use well stopped. Whenever you want to give the flavour of those flowers to any liquor, sweeten it with this syrup. To every four ounces of flowers, the quantity of sugar requisite to make that syrup is generally one pound and a half. Observe that all flowers must be well picked of all their cups, staminas, &c. and nothing but their leaves made use of.

363. *Raspberry syrup.*

Mash the raspberries, and dilute them with a moderate addition of water, then strain them to divide the thick from the clear part. To every quart of this clear liquor put one pound of lump sugar pulverised, boil all together on the fire in the preserving pan. Skim and clarify carefully the sugar, with the white of an egg beaten in water. When the syrup is come to its right degree (which you may know by throwing a drop of it in a glass of water, if the drop sinks whole to the bottom, and fixes itself there, without running out along with the water, when you throw this away) take it off the fire, and let it cool for bottling.

364. *Apricot syrup.*

Cut in small bits six pounds of very ripe apricots, which boil in a gallon of water till they are reduced to a pulp. Let them cool, then squeeze them through a sieve. Now strain

again this liquor through the jelly-bag and it in the preserving pan on the fire, with four pounds of sugar. Skim, clarify, and boil the whole to a syrup, which try as above directed in a glass of water; and, when done, let it cool, and bottle it to keep for use.

365. *A general manner of making syrups, applicable to almost all sorts of fruits, especially currents.*

1. Pick a quantity of red currants of all their stalks, and squeeze them through a sieve in a commodious vessel. Carry this vessel to the cellar, placing it on a stool or any suspending shelf from the ground: and, after that juice shall have worked three or four days, strain it through a sieve in another vessel, then through the flannel bag to get it as clear as possible.

2. Now for every two quarts of such liquor, have four pounds of sugar, which put in a preserving pan, and melt over the fire, with a little common water to help the dissolution of it. Boil it thus to the consistence of caramel, without burning it; and, when at that degree, pour through the holes of the skimmer the measured liquor, which must boil also to a perfect syrup according to the afore-prescribed trials.—All this being well executed, take it off, let it cool, and bottle it for use.

Note. All sorts of syrups, such as cherries, raspberries, and others, may be made in the same manner, with this difference only, that they are not to be put to work in the cellar, but employed directly as soon as the juice is squeezed out of the fruits.

366. *To make liquid current jam.*

Pick four pounds of currants, and clear them of their stalks. Put aside two pounds and a half of them in a dish, and squeeze the other one pound a half remaining. Now, in a preserving pan, dissolve four pounds of sugar; and, when come to a syrup, put in the two pounds and a half of whole currants, along with one pound and a half of juice of the same. and boil all together to perfection.

367. *To preserve apricots.*

Chuse a quantity of apricots, just turned, but not ripe, and the fruit of which has still all its hardness and greenness.—Take out the stones, by means of a small bladed knife, which introduce at the point of the apricot, till you feel the stone, and then push to make it come out at the tail. When you have thus prepared four pounds of them (weighed after stoning) have a large wide pan of boiling water on the fire, in

which throw them in order to blanch them, taking great care that they should not spot in the water. When blanched, take them out with a skimmer, and set them a-draining on a sieve. Then boil and clarify four pounds of sugar into a syrup. When done, take it out, and put in your apricots softly, set them again on the fire, and give them two or three bubbles; take the pan from the fire and let them cool. By this means they throw off their superfluous moistness and take the sugar. When cold, take them from the sugar with a skimmer, and set them a-draining, while you put the syrup on the fire to boil. When drained, put them again in the boiling syrup, and give them five or six bubbles more, after which let them rest till the next day, put them again on the fire, and finish them. They will be what is called Liquid, and you may pot them in that state.

368. *How to make a dry preserve of them.*

Proceed as above-directed, till the time they are fit for being potted in liquid, instead of which take them again out of the syrup, and set them a-draining, then range them on slates at regular distance, so that they may not touch one another. When thus prepared, powder on them, through a silk sieve, some of the finest loaf sugar pulverised, and put them in the stove to dry. When dry on that side, take them out from the slates, and turning them the other side upwards on a sieve, or some sort of small light willow grates made on purpose; powder them with sugar as before, and when equally dried and cooled, you may put them in boxes with white brown paper.

Note. All sorts of plums admit of the same mode of operation, to make them into dry or liquid preserves.

369. *To make the* Cotignac *liquid.*

Pare the quinces, and cut them small, after having taken away the cores and kernels. Put a gallon of water a boiling, then put them in, and let them boil, till reduced almost to a pulp. Strain all through a cloth, and squeeze it well into a bowl. Then set it on the fire in the preserving pan, with four pounds of sugar, and boil it gently, till taking some with the skimmer, and letting it fall on a plate, it shall rise up like a jelly, push on the fire, and in five minutes after the *Cotignac* is done.

Note. If you put the peel and kernels into a knot, and boil them in that manner in the water, the jam will sooner be red.

370. *To make dry portable cherries.*

Prepare four pound of fine *Kentish* cherries, by depriving them of their stones and tails. Then have one pound of sugar, which put a dissolving on the fire in a pint of water. When this begins to boil, throw your cherries quickly in, and make them boil thus in the sugar till the syrup begins to thicken. When they are sufficiently done, take them from the fire, and let it cool, after which put them a draining in a sieve; then range them on slates, and powder through a sieve some sugar all over them, and place them in the stove, or for want of this conveniency in a baker's oven, after the bread has been taken out. When dry on one side turn them on the other, and powder them over with sugar as you did before; dry them in the same manner, and box them when cold, to keep for use.

Note. Plums may be done in the same manner. This sort of preserve is very agreeable, and may be carried any where.

371. *To make an apricot, or peach jam.*

1. Chuse the ripest apricots, which clean of all hard knobs, spots and rotted parts. Cut them in small bits in a preserving pan, which have previously weighed. If you have put four pounds of apricots in it, reduce them by boiling over a gentle fire to two pounds only, which you must find out by weighing pan and fruit together, now and then till you find your right weight. When this is the case, put among your apricots thus reduced to one half, two pounds of lump sugar pulverized, and mix all well for the space of five minutes over the fire, then take all off, let it cool, and pot.

2. This composition you may put into paste, on slates or in tin moulds. There is not more exquisite eating. You may also, with two or three roasted, or baked apples, mix two spoonfuls of this marmalade, and make excessive nice tarts with it, or again, with pears baked under ashes.

372. *An apricot jam, after the* French *way.*

1. Chuse such ripe apricots as are fit to eat. Peel their skin off very neatly, and give them a bubble or two in boiling water, so as not to have them dissolve in the water, and put them draining. When done, mash them through a sieve, and let them rest a time to evaporate their superfluous moistness.

2. While this is doing, make a syrup with as many pounds of sugar as you have fruit, and take it off the fire; when the

syrup is cooled, put your fruit in, which stir well with the spatula, then put all again on the fire for ten minutes, in order to make the fruit take well the sugar. When the jam is well done, fine and transparent, pot it.

373. *To make raspberry, currant and cherry jam.*

All these fruits must be squeezed through a sieve, then clarify the sugar, and throw in the juice, bring to perfection afterwards as directed in the last receipt.

374. *To make a good currant jelly.*

Have four pounds of currants, after picking. Then dissolve in water four pounds of loaf sugar, which make into a pretty strong syrup. Now put the currants in, and boil so as to have them covered with the bubbles. Six minutes after such a boiling, take the pan from the fire, and pour the contents in a sieve to strain off all the liquid. Put this liquor again in the pan and boil it, till taking a drop with the skimmer, and pouring it on a plate, it congeals as it cools. Then it is fit to pot.

They who want to spare the sugar, and have a great deal of jelly at a smaller expense, may employ four pounds only of sugar to six of currants, after picking and proceed as above. They must however observe to do the jelly rather more than in the preceding case, when the fruit and sugar are pound for pound.

375. *To make an apple jelly.*

1. Cut in small bits a dozen of gold rennets, and put them in the preserving pan, with three quarts of water, which boil to the reduction of one half. Throw all in a cloth to strain it through, and draw all the juice from the apples. Then to this, put four pounds of sugar, which boil to a jelly.

2. To give a *pointe* to that jelly, you may add the juice of one lemon, and even the rasping of one half of its rind.

376. *A conserve with rasping of Portugal oranges and lemons, conjointly or separately.*

Put your raspings to dry in a plate. Prepare some sugar into a syrup, not quite so strong as recommended in the last receipt. Take this from the fire, and stir it with a spoon, round the pan and in the middle; then throw in your raspings of lemon or orange, or both together, and having stirred all well, put it in the moulds and make your drops.

377. *To whiten cherries, currants, raspberries, grapes, strawberries and such like fruit.*

Beat one or two whites of eggs with orange flower-water, then steep your fruit in, and roll it afterwards in a dish wherein there is lump sugar pulverised and sifted very fine.—When it is well covered over with sugar, put it on a sheet of paper, and set it in the sun to dry. You may thus ice all sorts of fruits susceptible of icing.

378. *How to preserve orange peels all the year, but especially in May.*

Cut some oranges in four quarters and peel them. Then put the peels to soak in water for about ten or twelve days; then dry them between two cloths, and put them in a caldron with a sufficient quantity of honey to half cover them. Boil them thus one minute or two, stirring them incessantly. Then take them off the fire, and let them rest till the next day, put them on again, and let boil ten minutes or a quarter of an hour. For six or seven days repeat the same operation, taking great care incessantly to stir, turn them all the while they are on the fire. On the eighth day change the honey; and in the fresh honey boil them five minutes, then pot them with that new honey in which they boiled last, and keep them for use, after having added some cinnamon, cloves, and white ginger, mixed and both reduced into subtile powder.

379. *The Genoa paste.*

Take equal quantities of quinces and odoring apple pulp. The pulp is prepared thus: peel these fruits, and clear them of their kernels. Then pound them in a mortar with rose water, and strain them through a sieve. Put the paste on the fire to dry by degrees, stirring it all the while with a wooden spatula. Then add as much sugar in powder as you have pulp, and go on in doing it, till it has acquired the consistence of a paste.

380. *Quinces jam, and other fruits.*

Boil in a sufficient quantity of water, both the flesh and the peelings of your fruits to perfect softness. Then let the decoction clarify in the sun, when settled, decant it, and adding to the liquor the proper quantity of sugar, boil it to a jelly.

381. *Genoa biscuits.*

Take four ounces of sugar in powder, one pound of flour, a little coriander and anniseeds in powder, which mix with four eggs and as much lukewarm water as needs to make a dough of the whole. Bake it in the oven, and when baked, cut it in five or six slices, which you bake again.

382. *Macaroons.*

Pound well one pound of sweet almonds, moistening them with rose water. Introduce one pound of sugar, and beat all well in a soft paste, which put round a dish, and half bake in a lukewarm oven. When the paste is half done, cut it in small round pieces, and having ranged them on a sheet of paper, finish baking them.

383. *Particular method of making cakes.*

Wash and clean well a dozen of eggs, and wipe them thoroughly dry. Then break them and take their whites only, which beat in a mortar along with their shells till these latter be perfectly dissolved. Now add sugar and flour, though not so much flour as sugar. When all is well mixed, spread the paste, which ought to be a little firm, on a sheet of paper, and after having glazed it, bake it in a slow oven.

384. *A cream which cuts as a rice pudding.*

Beat in a dish two whites of eggs and one yolk, in which, while you beat, introduce by degrees a quarter of a pound of sugar in proportion as it melts and a pap spoonful of rose water. When completed, pour in the dish, and stir, a quart of milk and cream mixed half and half, then set it gently on warm cinders to take without boiling, not disturbing it any more. In an hour's time it generally is sufficiently taken.—Then colour it in passing a red hot shovel over it. It is to be served cold, after having rasped some sugar on it.

385. *To make an exceeding good boiled cream.*

Take cream from the cow, which boil with a crum of stale bread, rasped very fine, and a little fresh butter. As soon as it begins to quake, stir it continually with a spoon; and having diluted some yolks of eggs, strain them through a cloth. Put as much salt and sugar in your cream as you think it requires. And when it boils and begins to rise, pour the yolks of eggs in, never ceasing to stir it in order to prevent its rising so far as to run over. As soon as you see it be-

gins to render the butter, take it out of the fire, and to serve, glaze it over with sugar in powder.

386. *How to reduce tobacco into powder.*

Uncord the tobacco, and spread the leaves to dry in the sun. Then pound them in a mortar, and sift through a coarse sieve to get the coarsest powder out of it. As for sifting, observe to do it in due proportion as you pound it, and not to pound much at a time. You may also take another method, that of grinding it in one of those small mills which are made on purpose for grinding tobacco. By these means you may, without much trouble, make it as coarse and as fine as you like, by screwing tighter or slacker the nut.

387. *How to purge snuff, and prepare it for admitting of odours.*

Have a small tub pierced with a hole at bottom, which you may stop and unstop with a cork as you want it. In this tub put a very thick and close weaved cloth, which turn over the rim of the tub and fix there by the outside. Put your snuff in it, and pour water over it. After it has soaked thus twenty-four hours, unstop the hole of the tub and let the water drain away, wringing the cloth in which it is to help the expression of the water. Repeat this operation three different times to purge it the better. When this operation is performed, set the snuff to drying in the sun. When dry, put it again in the tub in the same manner as before, and soak it again, not with common water, but with some smelling ones, such as for example, orange flower water, *eau-d'ange*, &c. Twenty-four hours after let the water run off and drain, then set it in the sun to dry as before. In the mean while stir and asperse it again with smelling water. Such is the indispensible preparation absolutely requisite to dispose snuff to receive the odour of flowers. If you do not care to have it so perfectly nice, and should not like to waste so much of it, you may give it but one wash of the common water. This moderate purgation will do pretty well, especially if, while it is a drying in the sun, you knead it the more often in proportion with your fragrant waters, and let it dry each time between.

388. *How to perfume snuff with flowers.*

The tuberose, the jessamine, the orange flowers, &c. and those which communicate the more easily their fragrancy to the snuff. To produce this, have a box lined with white paper perfectly dry, in which make a bed of snuff, the thickness of an inch, then one of flowers, another of snuff, and an-

other of flowers again, continuing so to do till you have employed all your snuff. After having let this stratification subsist for twenty-four hours, separate the flowers from the snuff by means of the sieve, and renew the same stratification again as before with new flowers. Continue thus to do till you find that your snuff has acquired a sufficient fragrancy from the flowers: then put it in lead boxes to keep it.

389. *The odouring snuff after the method practised at* Rome.

Take the snuff after its being perfumed with flowers, and put it in a large bowl or other proper vessel. Pour over it some white wine with an addition of essences of musk and amber, or any other such like odours. Then stir your snuff and rub it all between your hands. In this manner you may have snuff of whatever odour you desire, which, to distinguish from each other, you put into separate lead boxes with a particular mark.

390. *The snuff with the odour of civet.*

Take a little civet in your hands with a little snuff; spread that civet, more and more in bruising with your fingers, and an addition of snuff. After having mixed and remixed it thus in your hand with the whole quantity of snuff, put all again together in its box as before. You may do the same with respect to other odours.

391. *Amber-snuff.*

Heat the bottom of a mortar, and pound in it twenty grains of amber, adding by degrees a pound of snuff to it, which rub and mix afterwards with your hands to introduce the odour the better among it.

392. *The odoring snuff, Malthese fashion.*

Take a snuff ready prepared with orange flower water, (as directed in art. 387,) then perfume it with amber as we have just said; after which with ten grains of civet, pound with a little sugar in a mortar, introduce again your snuff, by degrees, to the quantity of a pound for these ten grains, increasing either the snuff or the odours in the same proportion to each other.

393. *The true Malthese method of preparing snuff.*

Take rose tree and liquorice roots, which peel and reduce them into powder and sift it, then give it what odour you

like, adding white wine, brandy or spirit of wine, and mix your snuff well with this. Such is the true Malthese method of preparing snuff.

394. *The Spanish method of preparing perfumed snuff.*

1. Pound in a small mortar twenty grains of musk with a little sugar. Add by degrees as much as a pound of snuff to it; then pound ten grains of civet, and introduce your musked snuff to it in a gradual manner as before, and rub altogether between your hands.

2. The Seville-snuff is the same with only an addition of twenty grains of *vanilla*, an ingredient which enters in the composition of chocolate.

3. They who are fond of a milder and sweeter odour in their snuff may increase the quantity of snuff for the prescribed doses of odours, or diminish the doses of odours prescribed for the quantity of snuff. Take care not to let odouring snuff be exposed to the air, but keep it very close for fear it should lo e it fragrancy.

4. As the Spanish snuff is excessively fine and drawing towards a reddish hue, to imitate it in the above prescription you must chuse fine Holland well purged, reddened and granulated, pound and sift it through a very fine silk sieve. Then give it whatever odour you like, after having purged it in the manner we prescribed in article 387.

5. There is no inconveniency in taking a snuff already prepared with flowers, to give it afterwards, an odour of amber, musk, and other perfume. On the contrary, such a snuff is the readier to take the other odours, and preserve them so much the longer.

395. *To give a red or yellow colour to snuff.*

Take the bulk of a nut of red or yellow ochre, with which mix a little white chalk to temperate the above colours at your pleasure. Grind either of the e ochres with three drachms of oil of almonds; then continuing to grind it on the stone, add by a little at a time some water to it till you see the paste admits of it freely and becomes very smooth and equal. Now take some gum adragant water and introduce it to the above paste, stirring continually. At last gather it in a large glazed bowl, and dilute it in about a quart of common water. Then take your snuff, well purged and prepared as in art. 387, and throw it in this bowl, wherein handle and rub it well to make it take the colour more regularly and equally. When it is thus made all into a lump, let it rest twenty-four hours before putting it to dry in the sun, which immediately after spreading it on a dry cloth and turning it now and then to

help its drying. Then gum it again by aspersion with gum adragant pulverised and dissolved into some smelling water; or you may again dip your hands into that water, and rub your snuff between your hands thus wetted, which last method is preferable, as it gums the snuff infinitely more regular. Lastly, dry it again in the sun; and when perfectly dry, sift it through the finest sieve you can find, and then it will be ready to admit of whatever odour you please to impregnate it with.

396. *To take off iron moulds from linen.*

Put boiling water into a bowl, and spread the stained parts of your linen over it, as to be well penetrated with the steam of the water. Then rub the places with sorrel juice and salt till they are perfectly soaked. Such linen washed afterwards in the lye of wood ashes, will be found to return entirely free from the iron mould spots it had before.

397. *To take off carriage wheel grease from clothes.*

Rub the place with butter. Then with blotting paper and a hot iron you may take all off as you would a drop of wax or tallow on a cloth.

398. *To take off spots from cloth of any colour.*

Take half a pound of crude honey, the yolk of a new laid egg, and the bulk of a nut of ammoniac salt. Mix altogether, and put some on the spots. Having left it there a while, wash the place with clean water, and the spot will disappear.

399. *A receipt against all sorts of spots upon stuff.*

A water impregnated with alkaline salt, black soap and bullock's gall, take off extremely well the greasy spots from any cloth or silk stuff.

400. *Against oil spots.*

Take a piece of white soap, shaved very fine, and put in a quart bottle with a wide mouth and neck, half filled with lye. Add to this the bulk of a nut of ammoniac salt, two yolks of eggs, cabbage juice and bullock's gall a discretionable quantity, one ounce of salt of tartar in subtile powder sifted. Stop the bottle well, shake it and expose it to the sun for four days. After that time if you pour off that liquor on

any oil spot, and rub it well with it in and outside, then let it dry, and wash it again with clear water.

401. *To take out pitch and turpentine spots.*

Rub well the spot with oil of olive, which set to dry for one day. Then with warm water and the above washing ball, you will entirely ungrease the place.

402. *Against ink spots, whether on cloth or linen.*

Wet immediately the place with lemon, or sorrel juice, or with white soap diluted in vinegar.

403. *For silks.*

If you rub the spots which are upon a silk with spirit of turpentine, they will disappear; because the volatility of that spirit exhaling into vapour, carries along with it the oil of the spot to which on account of its homogeneous quality, it communicates it volatility, by penetrating and subdividing it infinitely.

404. *To restore gold and silver lace to their former beauty.*

Mix equal quantities of water, bullock's and jack's gall.—With this composition, rub your gold or silver, and you will see it changing colour directly.

405. *To restore Turkey carpets to their first bloom.*

Beat the carpet well with a rod, till perfectly free from dust. Then if there be any spots of ink, take them out with a lemon, or with sorrel, and wash the place afterwards with clear water. Shake the rest of the water off, and let it dry, rub the carpet very hard all over with the smoaking hot crum of a white loaf; and when you find in the evening the skies clear and a likelihood of being a fine night, let the carpet be put out for two or three such nights.

406. *To make tapestries resume their first brightness, when their colours have been tarnished and spoiled.*

Shake and clean well the tapestry by rubbing it all over with white chalk, which leave on it for about one day. Next with a rough hair brush get all that chalk out again, and put on fresh, which leave as before. Then with the same rough hair brush get this out also, and beat it soundly with a rod,

and brush it afterwards with a soft cloth-brush. This operation will restore a tapestry to its pristine state.

407. *To take off spots of wax from velvet of any colour, except the crimson.*

Take the crum of a stale loaf, and cut a thick slice out of it, which toast and apply, while burning hot, on the spot of wax; when cooled, renew it till all the wax is soaked out of the velvet.

408. *To wash a gold or silver, or silk embroidery, or any stuff whatever, and render it like new.*

Take bullock's gall, a pound, soap and honey, three ounces of each, and Florentine orrice, about the same quantity in subtile powder. Put all in a glass vessel, in which mix it well into a paste, and let it be exposed for ten days in the sun. When you are ready to use it, make an infusion of bran, which boil in water and strain through a cloth. Then smear the work over with the above described paste, in such places as you want to clean, and wash them afterwards with bran water, renewing this till it receives no more alteration in its colour. Wipe well the places with a white cloth and wrap the work in a clean napkin to set it in the sun to dry, after which pass it through the polishing and lustring press, and the work will be as fine and bright as when new.

409. *To revive the colour of a cloth.*

Pour one quart of water on one pound of burnt pot-ashes. Twelve hours after decant the water off in another vessel, and put in a handful of dry moth mullin leaves, with two bullock's galls. Boil altogether till the leaves go to the bottom. Then set this water for a few days in the sun. Then putting in it whatever colour you want, boil it with the cloth in that lye, and let it thus soak afterwards fourteen or fifteen days, then the cloth will have resumed its primary colour.

410. *To take the spots off from a white cloth.*

Boil two ounces of alum for half an hour, in a pint, or a pint and a half of water; then put in a piece of white soap, with another pound of alum; and having soaked thus three days in the cold, you may with it wash all the spots of any white cloth whatever.

411. *A composition of soap to take off all sorts of spots.*

1. Take a pound of *Venetian* white soap, six yolks of eggs and half a spoonful of salt pounded. Incorporate all together

with a sufficient quantity of the juice from the leaves of white beet. Make this composition into small cakes, which dry in the shade.

2. To use them, wet the place of the cloth where the spot is, with clear water, and rub it over on both sides with the said soap, then washing it the spot will disappear.

412. *How to entice a great quantity of fish to resort to a certain place.*

Grind together coculas Indicus, cummin and some old cheese, make a paste of it with wine-lye and wheat flour.—When all is well incorporated, make it into pills the size of a pea. Throw them into a river or pond, wherein you know there is a great quantity of fish, in a part where the water is clear and undisturbed. Every fish who shall swallow those pills will be so intoxicated that they will all come to the side of the water, and you will be able to take them with your hand. In a short time their intoxication will go off and they will become as brisk as ever they were before eating that bait.

413. *How to get a good many birds.*

Put a-soaking some birds seed in good brandy, with a little white hellebore, and place it in some part of your garden as a bait for the birds which frequent it, and those that eat of that seed will be so suddenly intoxicated by it, that they will suffer themselves to be taken by the hand.

414. *To preserve and multiply pigeons.*

In a large dovecot, prepare the following food which will induce your pigeons to love their cot, also to bring you a great many strangers when they go abroad. Take thirty pounds of millet, three of cummin, five of honey, half a pound of bishop's wart, otherwise *costus*, two pound of *agnus castus* seed, which boil in river water to the evaporation of the last. Then in its stead pour a gallon and a half or two gallons of red Port, with eight pounds of mortar, well pulverised, which set on the fire for an hour to concoct. Thus all those ingredients will harden and form a lump, which if placed in the middle of the dovecot, will in a short time amply reward you for your expense.

415. *How to fatten pigeons.*

Experience shews that nothing will keep pigeons in better order, and fatten them sooner, than a paste made of fried beans with cummin and honey.

416 *POTTERY.*

Pottery, or the art of making vessels of baked earth, is of the remotest antiquity. The ancient Greeks and Etruscans particularly excelled in it. Porcelain, the most perfect species of pottery, has been made in China from time immemorial.

Alumine and silex are two substances of which every kind of earthen ware is made. Clay alone shrinks and cracks; the flint gives it solidity and strength.

Common pottery, such as coarse brown jugs, &c. are made of the ordinary clays, which are a mixture of sand and clay, coloured by oxyde of iron. The clay is well ground, or kneaded, and a lump of it is put upon the centre of a wheel which is kept in motion; then, by means of the workman's hand, or by proper tools, it is formed into the required shape. The pieces are then dried moderately, so as to bear being removed without danger; they are then covered with a glaze, made from semi-vitreous oxyde of lead, and put into a furnace, where they are baked. Some sorts are glazed by throwing sea-salt into the furnace among the different pieces of pottery. The salt is decomposed, and the vapours of it form a glazing upon the vessels; but this, though a very simple and ingenious method, does not form a good glazing.

English stone ware is made of tobacco pipe clay, mixed with flints calcined and ground. This mixture burns white, and vessels of this were at first glazed with sea-salt. Mr. WEDGWOOD was the first who introduced a superior kind of it, now so common, called *queen's ware.* The tobacco pipe clay is much beat in water; by this process the finer parts remain suspended in the water, while the coarser, sand, and other impurities, fall to the bottom. The thick liquid, consisting of water and the finer parts of the clay, is further purified by passing it through hair and lawn sieves, of different degrees of fineness. After this, the liquid is mixed (in various proportions for various wares) with another liquor of the same density, and consisting of flints calcined, ground, and suspended in water. The mixture is then dried in a kiln; and being afterwards beaten to a proper temper, it becomes fit for being formed at the wheel into dishes, plates, bowls, &c. When this ware is to be put into the furnace to be baked, the several pieces of it are placed in cases made of clay, called seggars, which are piled one upon another in the dome of the furnace; a fire is then lighted, and the ware is brought to a proper temper for glazing. It is then dipped into a glaze, made by mixing together in water, till it becomes as thick as cream, 112 parts of white lead, 24 parts of ground flint, and 6 parts of ground flint glass. The ware, by being

baked, acquires a strong property of imbibing moisture, and in this state is called *biscuit:* when dipped into the glaze, therefore, it greedily attracts it into its pores, and the ware presently becomes dry. It is then exposed a second time to the fire, by which means the glaze it has imbibed is melted, and a thin glassy coat is formed upon its surface. The colour of the coat is more or less yellow, according as a greater or less proportion of lead has been used. The lead is principally instrumental in producing the glaze, as well as in giving it the yellow colour; for lead, of all the substances hitherto known, has the greatest power of promoting the vitrification of the substances with which it is mixed. The flint serves to give a consistency to the lead during the time of its vitrification, and to hinder it from becoming too fluid, and running down the sides of the ware, and thereby leaving them unglazed.

This glazing, made by means of lead, is liable to be attacked by acids, and is supposed to be productive of deleterious effects, when employed in jars used for pickling, &c.

The following composition has been recommended as a substitute:

To make this, white glass and soda, in equal portions, must be very finely pulverised, carefully sifted, and well mixed. The mixture is then exposed to a strong heat, till it is rendered very dry. It is afterwards put into vessels which have been already baked; is then melted, and the varnish is made. It may be applied in the same manner as that in common use.

The advantage of it is, that it is safe, and can have none of those poisonous effects which arise from the decomposition of the lead varnish.

Porcelain, or china, is a semi-vitrified earthen ware, of an intermediate nature between common ware and glass. Chinese porcelain is composed of two ingredients, one of which is a hard stone, called *petuntse*, which is carefully ground to a very fine powder; and the other, called *kaolin*, is a white earthy substance which is intimately mixed with the ground stone. The former is of the siliceous, and the latter of the aluminous genus.

The Chinese long excelled in the art of making porcelain, but it is now made in various parts of Europe of an equally good quality, and much more ornamental.

By genuine or *true porcelain*, such pottery is understood as is infusible in the strongest fire excited in furnaces; is hard, but not so brittle as glass; proof against any sudden and great changes of heat and cold; finely grained, dense, and without gloss in the fracture; not glassy, and of a peculiar transparency.

Several compositions of mingled earths may yield a true porcelain, by being burnt; and the porcelains of various

countries differ in their mixtures. But the principal basis of any true porcelain, is that kind of clay which becomes white by baking, and which, either by intermingled heterogeneous earth, or by particular additions, undergoes in the fire an incipient *vitrification*, in which the true nature of porcelain consists. Feldspar and gypsum, if added, may give that property to infusible clay.

When porcelain is to be made, the clay is properly selected, carefully washed from impurities, and again dried. It is then finely sifted, and most accurately mingled with quartz, ground very fine; to which, then, is added some burnt and finely pulverised gypsum. This mass is worked with water to a paste, and duly kneaded; it is usually suffered to lie in this state for years. The vessels and other goods formed of this mass, are first moderately burnt in earthen pots, to receive a certain degree of compactness, and to be ready for glazing. The glazing consists of an easily melted mixture of some species of earths, as the petrosilex or chert, fragments of porcelain and gypsum, which, when fused together, produce a crystalline, or vitreous mass, that, after cooling, is very finely ground, and suspended in a sufficient quantity of water. Into this fluid the rough ware is dipped, by which the glazing matter is deposited uniformly on every part of its surface. After drying, each article is thoroughly baked or burned in the violent heat of the *porcelain furnace*. It is usual to decorate porcelain by paintings, for which purpose, enamels or pastes, coloured by metallic oxydes, are used, so easy of fusion as to run in a heat less intense than that in which the glazing of the ware melts.

Delft ware, so called because first made at Delft in Holland, is a kind of pottery made of sand and clay, and but slightly baked, so that it resists sudden application of heat. Articles made of this are glazed with an enamel, composed of common salt, sand ground fine, oxyde of lead, and oxyde of tin. The use of the latter is to give opacity to the glaze.

Tobacco pipes require a very fine, tenacious, and refractory clay, which is either naturally of a perfectly white colour, or if it have somewhat of a grey cast, will necessarily burn white. A clay of this kind must contain no calcareous or ferruginous earth, and must also be carefully deprived of any sand it may contain, by washing. It ought to possess, besides, the capital property of shrinking but little in the fire. If it should not prove sufficiently ductile, it may be meliorated by the admixture of another sort. Last of all, it is beaten, kneaded, ground, washed, and sifted, till it acquires the requisite degree of fineness and ductility.

When, after this preparation, the clay has obtained a due degree of ductility, it is rolled out in small portions to the usual length of a pipe, perforated with a wire, and put, to-

gether with the wire, into a brass mould rubbed over with oil, to give it its external form ; after which it is fixed into a vice, and the hollow part of the head formed with a stopper. The pipes, thus brought into form, are cleared of the redundant clay that adheres to the seams, a rim or border is made round the head, they are then marked with an iron stamp upon the heel, and the surfaces smoothed and polished. When they are well dried, they are put into boxes, and baked in a furnace. In the Dutch manufactories, these boxes consist of conical pots made of clay, with conical lids, with a tube passing through the middle of them, by which the pipes are supported ; or else, they are long clay boxes, in which the pipes are laid horizontally, and stratified with fragments of pipes pounded small.

Lastly, the pipes, when baked, are covered with a glazing or varnish, and afterwards rubbed with a cloth. This glazing consists of a quarter of a pound of soap, two ounces of white wax, and one ounce of gum arabic, or tragacanth, which are all boiled together in five pints of water, for the space of a few minuets.

417. *OF ENGRAVING IN AQUA TINTA.*

Aqua tinta is a method of producing prints very much resembling drawings in Indian ink.

The principle of the process consists in corroding the copper with aqua fortis, in such a manner, that an impression from it has the appearance of a tint laid on the paper. This is effected by covering the copper with a powder or some substance which takes a granulated form, so as to prevent the aqua fortis from acting where the particles adhere, and by this means causes it to corrode the copper partially, and in the interstices only. When these particles are extremely minute and near to each other, the impression from the plate appears to the naked eye exactly like a wash of Indian ink ; but when they are larger, the granulation is more distinct, and as this may be varied at pleasure, it is capable of being adapted, with great success, to a variety of purposes and subjects.

This powder, or granulation, is called the *aqua tinta grain*, and there are two general modes of producing it.

We shall first describe what is called the *powder grain*, because it was the first that was used.

Having etched the outline on a copper plate, prepared in the usual way by the copper smith (for which see the article Etching,) some substance must be finely powdered and sifted, which will melt with heat, and when cold will adhere to the plate, and resist the action of aqua fortis. The substances which have been used for this purpose, either separately or

mixed, are *asphaltum, Burgundy pitch, rosin, gum copal, gum mastich;* and, in a greater or less degree, all the resins and gum resins will answer the purpose. Common rosin has been most generally used, and answers tolerably well; though gum copal makes a grain that resists the aqua fortis better.

The substance intended to be used for the grain must now be distributed over the plate as equally as possible; and different methods of performing this essential part of the operation have been used by different engravers, and at differant times.

The most usual way is to tie up some of the powder in a piece of muslin, and strike it against a piece of stick, held at a considerable height above the plate; by this, the powder that issues falls gently, and settles equally over the plate. Every one must have observed how uniformly hair powder settles upon the furniture after the operations of the hair dresser. This may afford a hint towards the best mode of performing this part of the process. The powder must fall upon it from a considerable height, and there must be a sufficiently large cloud of the dust formed. The plate being covered equally over with the dust, or powder, the operator is next to proceed to fix it upon the plate, by heating it gently, so as to melt the particles. This may be effected by holding under the plate lighted pieces of brown paper rolled up, and moving them about till every part of the powder is melted; this will be known by its change of colour, which will turn brownish. It must now be suffered to cool, when it may be examined with a magnifier, and if the grains or particles appear to be uniformly distributed, it is ready for the next part of the process.

The design or drawing to be engraved must now be examined, and such parts of it as are perfectly white, are to be remarked. Those corresponding parts of the plate must be covered, or stopped out, as it is called, with turpentine varnish, diluted with turpentine to a proper consistence, to work freely with the pencil, and mixed with lamp black to give it colour; for if transparent, the touches of the pencil would not be so distinctly seen. The margin of the plate must also be covered with varnish. When the stopping-out is sufficiently dry, a border of wax must be raised round the plate, in the same manner as in etching, and the aqua fortis properly diluted with water poured on. This is called biting-in, and is the part of the process which is most uncertain, and which requires the greatest degree of experience. When the aqua fortis has lain on so long that the plate, when printed, would produce the lightest tint in the drawing, it is poured off, and the plate washed with water, and dried. When it is quite dry, the lightest tints in the drawing are stopped-out, and

the aqua fortis poured on as before, and the same process is repeated as often as there are tints to be produced in the plate.

Although many plates are etched entirely by this method of stopping-out and biting-in alternately, yet it may easily be conceived, that in general, it would be very difficult to stop round, and leave out all the finishing touches, as also the leaves of trees and many other subjects, which it would be impossible to execute with the necessary degree of freedom in this manner.

To overcome this difficulty, another very ingenious process has been invented, by which these touches are laid on the plate with the same ease and expedition as they are in a drawing in Indian ink. Fine washed whiting is mixed with a little treacle or sugar, and diluted with water in the pencil, so as to work freely, and this is laid on the plate covered with the aqua-tint ground, in the same manner and on the same parts as ink on the drawing. When this is dry, the whole plate is varnished over with a weak and thin varnish of turpentine, asphaltum, or mastich, and then suffered to dry, when the aqua fortis is poured on. The varnish will immediately break up in the parts where the treacle mixture was laid, and expose all those places to the action of the acid, while the rest of the plate remains secure. The effect of this will be, that all the touches or places where the treacle was used, will be bit-in deeper than the rest, and will have all the precision and firmness of touches in Indian ink.

After the plate is completely bit-in, the bordering wax is taken off, by heating the plate a little with a lighted piece of paper; and it is then cleared from the ground and varnish by oil of turpentine, and wiped clean with a rag and a little fine whiting, when it is ready for the printer.

The principal disadvantages of this method of aqua tinting are, that it is extremely difficult to produce the required degree of coarseness or fineness in the grain, and that plates so engraved do not print many impressions before they are worn out. It is therefore now very seldom used, though it is occasionally of service.

We next proceed to describe the second method of producing the aqua-tint ground, which is generally practised. Some resinous substance is dissolved in spirits of wine, as common resin, Burgundy pitch, or mastich, and this solution is poured all over the plate, which is then held in a slanting direction till the superfluous fluid drains off; and it is laid down to dry, which it does in a few minutes. If the plate be then examined with the magnifier, it will be found that the spirit, in evaporating, has left the resin in a granulated state, or rather, that the latter has cracked in every direction, still adhering firmly to the copper.

A grain is thus produced with the greatest ease, which is extremely regular and beautiful, and much superior for most purposes to that produced by the former method. After the grain is formed, every part of the process is conducted in the same manner as above described.

Having thus given a general idea of the art, we shall mention some particulars necessary to be attended to, in order to ensure success in the operation. The spirits of wine used for the solution must be highly rectified, and of the best quality. What is sold in the shops, generally contains camphor, which would entirely spoil the grain. Resin, Burgundy pitch, and gum mastich, when dissolved in spirits of wine, produce grains of a different appearance and figure, and are sometimes mixed in different proportions, according to the taste of the artist, some using one substance and some another. In order to produce a coarser or finer grain, it is necessary to use a greater or smaller quantity of resin; and to ascertain the proper proportions, several spare pieces of copper must be provided, on which the liquid may be poured, and the grain examined, before it is applied to the plate to be engraved. After the solution is made, it must stand still and undisturbed for a day or two, till all the impurities of the resin have settled to the bottom, and the fluid is quite pellucid. No other method of freeing it from those impurities have been found to answer; straining it through linen or muslin, only fills it with hairs, which are ruinous to the grain. The room in which the liquid is poured on the plate must be perfectly still and free from dust, which, whenever it falls on the plate while wet, causes a white spot, which it is impossible to remove without laying the grain a-fresh. The plate must also be previously cleaned, with the greatest possible care, with a rag and whiting, as the smallest stain or particle of grease produces a streak or blemish in the grain. All these attentions are absoluteiy necessary to produce a tolerably regular grain; and, after every thing that can be done by the most experienced artists, still there is much uncertainty in the process. They are sometimes obliged to lay on the grains several times, before they procure one sufficiently regular. The same proportions of materials do not always produce the same effect, as it depends in some degree on their qualities; and it is even materially altered by the weather. These difficulties are not to be surmounted but by a great deal of experience; and those who are daily in the habit of practising the art, are frequently liable to the most unaccountable accidents. Indeed it is much to be lamented, that so elegant and useful a process should be so extremely delicate and uncertain.

It being necessary to hold the plate in a slanting direction, in order to drain off the superfluous fluid, there will naturally be a greater body of the liquid at the bottom than at the top

of the plate. On this account, a gain laid in this way is always coarser at the side of the plate that was held lowermost. The most usual way is, to keep the coarsest side for the fore ground, that being generally the part which has the deepest shadows. In large landscapes, sometimes, various parts are laid with different grains, according to the nature of the subject.

The finer the grain is, the more nearly does the impression resemble Indian ink, and the fitter it is for imitating drawings: but very fine grains have several disadvantages; for they are apt to come off before the aqua fortis has lain on long enough to produce the desired depth; and as the plate is not corroded so deep, it sooner wears out in printing; whereas coarser grains are firmer, the acid goes deeper, and the plate will throw off a great many more impressions. The reason of all this is evident, when it is considered, that, in the fine grains, the particles are small and near each other, and consequently the aqua fortis, which acts laterally as well as downwards, soon undermines the particles, and causes them to come off. If left too long on the plate, the acid would eat away the grain entirely.

On these accounts, therefore, the moderately coarse grains are more sought after, and answer better the purpose of the publisher, than the fine grains which were formerly in use.

Although there are considerable difficulties in laying properly the aqua tint grain, yet corroding the copper, or biting-in, so as to produce exactly the tint required, is still more precarious and uncertain. All engravers allow that no positive rules can be laid down, by which the success of this process can be secured; nothing but a great deal of experience and attentive observation can enable the artist to do it with any degree of certainty.

There are some hints, however, which may be of considerable importance to the person who wishes to attain the practice of this art. It is evident, that the longer the acid remains on the copper, the deeper it bites, and consequently the darker will be the shade in the impression. It may be of some use, therefore, to have several bits of copper laid with aqua tint grounds, of the same kind to be used in the plate, and to let the aqua fortis remain for different lengths of time on each; and then to examine the tints produced in one, two, three, four minutes, or longer. Observations of this kind, frequently repeated, and with different degrees of strength of the acid, will at length assist the judgment, in guessing at the tint which is produced in the plate. A magnifier is also useful to examine the grain, and to observe the depth to which it is bit. It must be observed, that no proof of the plate can be obtained till the whole process is finished. If any part appears to have been bit too dark, it must be burnished down with a steel burnisher; but this requires great delicacy and good

management not to make the shade streaky; and as the beauty and durability of the grain is always somewhat injured by it, it should be avoided as much as possible.

Those parts which are not dark enough, must have a fresh grain laid over them, and be stopped round with varnish, and subjected again to the aqua fortis. This is called re-biting, and requires peculiar care and attention. The plate must be very well cleaned out with turpentine before the grain is laid on, which should be pretty coarse, otherwise it will not lay upon the heights only, as is necessary, in order to produce the same grain. If the new grain is different from the former, it will not be so clear nor so firm, but rotten.

We have now given a general account of the process of engraving in aqua tinta, and we believe that no material circumstance has been omitted, that can be communicated without seeing the operation: but after all it must be confessed, that no printed directions whatever can enable a person to practise it perfectly. Its success depends upon so many nicities, and attention to circumstances apparently trifling, that the person who attempts it must not be surprised if he does not succeed at first. It is a species of engraving simple and expeditious, if every thing goes on well; but it is very precarious, and the errors which are made are rectified with great difficulty.

It seems to be adapted chiefly for imitation of sketches, washed drawings, and slight subjects; but does not appear to be at all calculated to produce prints from finished pictures, as it is not susceptible of that accuracy in the balance of tints necessary for this purpose. Nor does it appear to be suitable for book plates, as it does not print a sufficient number of impressions. It is therefore not to be put in competition with the other modes of engraving. If confined to those subjects for which it is calculated, it must be allowed to be extremely useful; as it is expeditious, and may be attained with much less trouble than any other mode of engraving. But even this circumstance is a source of mischief, as it occasions the production of a multitude of prints, that have no other effect than that of vitiating the public taste.

Engraving in aqua tint was invented by Le Prince, a French artist, who kept his process a long time secret, and it is said he sold his prints at first as drawings; but he appears to have been acquainted only with the powder grain and the common method of stopping out. The prints which he produced are still some of the finest specimens of the art. Mr. Paul Sanby was the first who practised it in this country, and it was by him communicated to Mr. Jukes. It is now practised very generally all over Europe; but no where more successfully than in Great Britain.

418. *ENGRAVING ON WOOD.*

Engraving on wood is a process exactly the reverse to engraving on copper. In the latter, the strokes to be printed are sunk or cut into the copper, and a rolling press is used for printing it; but in engravings on wood, all the wood is cut away, except the lines to be printed, which are left standing up like types, and the mode of printing is the same as that used in letter press.

The wood used for this purpose is box wood, which is planed quite smooth. The design is then drawn upon the wood itself with black lead, and all the wood is cut away with gravers and other proper tools, except the lines that are drawn. Or sometimes the design is drawn upon paper, and pasted upon the wood, which is cut as before. This art is of considerable difficulty, and there are very few who practise it. It is, however, useful for books, as the printing of it is cheaper than that of copper plates. It cannot be applied equally well to all the purposes to which copper plate engraving is applicable.

419. *Method of painting Japan Work.*

Japan work ought properly to be painted with colours in varnish; though, for the greater dispatch, and in some very nice work in small, for the freer use of the pencil, the colours are sometimes tempered in oil; which should previously have a fourth part of its weight of gum animi dissolved in it; or in default of that, gum sandarach, or gum mastich. When the oil is thus used, it should be well diluted with oil of turpentine, that the colours may lay more evenly and thin; by which means, fewer of the polishing or upper coats of varnish become necessary.

In some instances, water colours are laid on grounds of gold, in the manner of other paintings; and are best, when so used in their proper appearance, without any varnish over them; and they are also sometimes so managed as to have the effect of embossed work. The colours employed in this way, for painting, are best prepared by means of isinglass size, corrected by honey or sugar candy. The body of which the embossed work is raised, need not, however, be tinged with the exterior colour, but may be best formed of very strong gum water, thickened to a proper consistence by bole Armenian and whiting in equal parts; which being laid on the proper figure, and repaired when dry, may be then painted with the proper colours, tempered with the isinglass size, or, in the usual manner, with shell-lac varnish.

420. *To make bitter almond biscuits.*

Pound in a mortar, three quarters of a pound of bitter and one quarter of sweet almonds. When thus pounded have eight or nine yolks of eggs, which beat up and mix with your paste of almonds, and two pounds of pulverised lump sugar. This paste must be a deal harder than that of the Savoy biscuits. Then with the end of a knife, taking some of that paste, place it in rows on a sheet of paper, in what form or shape you like, and ice it with pulverised sugar, then put it in the the oven as you do the Savoy biscuits or massepins.

421. *To purify oil olive, that it may be eaten with pleasure.*

Take fair water two quarts, oil olive a pint: mix and shake them well together for a quarter of an hour in a glass; then separate the water from the oil with a separating funnel.—Do this four or five times or more, as you see occasion, till the oil becomes very pure; and the last time wash it with rose-water, then hang in the midst of the oil a coarse bag full of bruised nutmegs, cloves, and cinnamon, so will you give it an excellent taste.

422. *To make sage, parsley, or pennyroyal butter.*

When the butter is newly made, and well wrought from its water, milk and wheyish part, mix therewith a little oil of sage or parsley, so much till the butter is strong enough in taste to your liking, and then temper them well together; this will excuse you from eating the plants therewith; and if you do this with the aforesaid clarified butter, it will be far better, and a most admirable rarity.

423. *To make a candle that shall last long.*

Mix with your tallow unslacked lime in powder; or make your candles of castile-soap: such candles as these will be admirable for lamp furnaces. Now it is the salt in the lime and soap, that preserves the tallow from burning out so fast, as otherwise it would.

424. *To make the distilled oil out of any herb, seed, flower, or paper, in a moment without a furnace.*

You must have a long pipe made of tin, or tobacco-pipe clay with a hole in it as big as a small walnut, three or four inches from one end of it, into which you must put the matter, you would have the oil off; set it on a fire with a can-

dle or a coal; then put one end of the pipe into a bason of fair water, and blow at the other end, so will the smoak come into the water, and the oil will swim upon it, which you may separate with a funnel.

425. *An excellent perfuming powder for the hair.*

Take iris roots in fine powder one ounce and a half, benjamin, storax, cloves, musk, of each two drachms: being all in fine powder, mix them for a perfume for hair powder. Take of this perfume one drachm, rice-flower impalpable one pound, mix them for a powder for the hair. Note, some use white starch, flower of French beans and the like.

426. *A perfume to smoak and burn.*

Take labdanum two ounces, storax one ounce, benjamin, cloves, mace, of each half an ounce, musk, civet, of each ten grains, all in fine powder, make it up into cakes with mucilage of gum tragacanth in rose-water, which dry; and keep among your cloathes, which when occasion requires, you may burn in a chafing dish of coals.

427. *A remarkable circumstance concerning ale; with an unerring method of brewing malt liquor, that will soon be fine and fit for drinking; and far more palatable and wholesome than what is procured from the too common, erroneous way many brewers follow.*

Whoever brews, and expects to have either good ale or beer will be sure to be disappointed, if care is not taken to provide good malt and hops; nor is the water made use of so very immaterial an article as some imagine, for a great deal depends upon it. What I have above advanced, may very likely be credited by many; but when I come to tell them, there is more malt liquor spoiled by high boiling, than by all mismanagements put together, it is easy to perceive I shall have many obstinate infatuated people to encounter with, who very simply imagine, that ale or beer, cannot possibly be bad which has had a four hours boiling. It is well known there are many parts of England remarkable for fine malt liquors; and I as well know, that not one of the countries that have excelled in either ale or beer, ever boiled above half an hour at most. There is, indeed, a town in Devonshire, that is said to have constantly good ale. I am well acquainted with it; Barnstable no doubt, has a strong glutinous ale, that pleases many people; and those who brew I dare say, most scandalously boil it, at least four hours. But

what is the consequence? Why there is scarce a house in that place but affords a pair or two of crutches, and unhappy cripples to make use of them. I must own people in England have not followed this pernicious custom so much of late years. They find they are gainers by their reformation: and many have owned, they never had such valuable ale or beer, as, since they left off the old mistaken way of boiling for three or four hours, and acknowledge they have reduced it to less than a quarter of that time. There others again, who declare, to their customers, that they actually boil four hours; when in fact, a quarter of an hour is the most they have boiled for five or six years past. I believe this reformation is chiefly owing to some treatises published concerning brewing, in which the pernicious consequence of high boiling is sufficiently displayed and exploded. I will beg leave to give an instance of the bad consequences of long boiling, that will be sufficient to satisfy any person who practises it, of their error. A gentleman of my acquaintance, in Chester, often complained to me, that he bought the best of malt and hops; that they had fine water from the river Dee, and he had it constantly boiled full four hours; and yet notwithstanding all this, he could not have either good ale or beer. His lady too joined in the complaint, and said, it would be a great satisfaction if a remedy could be found, as many of the gentlemen who visited there preferred a glass of fine beer to any liquor whatever. I then told him, if he would have a brewing after my direction, I would be answerable, that it would prove satisfactory. Accordingly good malt and hops were provided, and the water was fetched from the river Dee, as usual. I must own it was with the utmost difficulty I prevailed on the man who brewed to boil it so short a time, who protested it would be good for nothing, However, I at length prevailed, and he proceeded in the following manner: the quantity of liquor was sixty gallons; and to put the thing quite out of dispute, and to prove that boiling long was erroneous, the first twenty gallons were boiled twenty six minutes; the second twenty gallons one hour and a quarter; and the third and last twenty gallons full two hours. In about a month, the three casks were examined: that which was boiled twenty-six minutes, proved extremely fine and well tasted, and gave a general satisfaction. But the cask which contained the liquor of the second boiling, was very far from being either so fine or pleasant. And the third cask which contained the last and long boiled liquor, proved very foul, and quite disagreeable in many other respects. Now as there was no difference in the management of the sixty gallons of ale I have been speaking of, boiling only excepted, how will the advocates for long boiling malt liquors account for this?

the same malt, hops and water, tunned at the same time, and in casks of the same size, and placed in the same good celiar, I have to add to this account, that at the two months end, the second boiling was foul and ill tasted, and was made fine with great difficulty. The last boiling was very foul and bad; at the end of six months it was cloudy, ropy, and ill tasted; some attempts were made in vain, to fine it; but at about ten months old, it was far worse. The gentleman, who, indeed, was too fond of long boiling, for many years before, as it had been often insinuated to him, that drink could not be boiled too much, was greatly pleased to find the first cask prove so exceeding good, with little boiling; he then gave orders to the man who brewed for him, never for the future to boil his liquor above twenty minutes, which directions were strictly observed: and it is now as uncommon to find any malt liquor that is bad in his cellars, as it was before to have any that was good. I would fain know what it is boiled for the length of four hours? Some tell you, 'tis to get the goodness out of the hops. To which I answer, it is a sad thing so many thousand gallons of malt liquor should be spoiled every year, only to get goodness (as they are pleased to call it) out of the hops, when many other means might be used to do it in a few minutes. In one word, the long boiling malt liquor has many bad properties attending it, without having any thing in its favour; for it renders such ale too gummy and sizy to be wholesome, and is the cause of many becoming cripples, who make a too frequent use of those pernicious long boiled liquors: for the blood, by this means, becomes too glutinous to pass the fine blood vessels: hence arise those various disorders! those pains! those aches! that render the unhappy cripples not only a fatigue themselves, but introduce disorders that are felt by future generations. Nor does the mischief stop here (though I must own this is the most melancholy part of it) for whenever such ale or beer proves foul, which is too commonly the case, it is with great difficulty made fine, and and fit for drinking. In short, those who once experience the great advantage that will result from boiling their liquor not longer than twenty-five or thirty minutes, will be sure to have this satisfaction, that their ale will be much better, pleasanter, and more wholesome, than those that are long boiled; by which they will not only preserve the health of those who drink it, but also have more liquor from the same quantity of malt; which very likely may be a means of prevailing, as interest is in the case, more than any other arguments.—It is to be remarked that all liquor should be boiled as nimbly as possible (so as not to make it run out of the boiler) and also that the long stupid way of boiling for the goodness of the hop, is of the utmost prejudice; for its fine flavour will be soon extracted: what comes after, by length of stewing, is

only an earthy, heavy, pernicious quality, that will be sure to render the ale disagreeable, and prove prejudicial to those who drink it.——Thus much I have presumed to say, in order to prevent the pernicious custom, that has too long prevailed: persons of reason will very likely try the experiment: 'tis on those I rely and on whom it will chiefly depend to decide, which method is best to pursue, that guided by reason, long experience, and the result of many years practice; or the method obstinately pursued by unreasonable bigots, and a set of infatuated old women.

428. *Of gilding leather.*

Leather may be gilded for common occasions by all the same methods which have been given for gilding paper or velum: except, that where the gold size is used, there is no occasion to wet the leather, to prevent the running of the oil out of the bounds. Either leaf gold or the powders may therefore be employed as well for leather as paper. But, unless, in some fine work, or for every particular purposes, the German gold powder would answer as well as the true gold. It is needless consequently to repeat here the methods above shown with respect to the gilding paper for covers to books, &c. which equally well suit for this purpose in general: but as there is a manner of gilding leather peculiar to the book binders, it is requisite to explain it. The method of gilding used by the book-binder, is to have the letters or copartments, scrolls, or other ornaments, cut in steel stamps; not by sinking, as in most other cases, but by the projection of the figure from the ground. These stamps are made hot; and leaves of gold being laid on the parts accommodated to the pattern or design of the gilding, the hot stamps are pressed strongly on the gold and leather; and bind the gold to it in the hollows formed by the stamp: the other redundant part of the gold being afterwards brushed or rubbed off. The manner practised by the professed leather gilders, for the making hangings for rooms, skreens, &c. is not properly *gilding*, but *laquering*, being done by means of leaf silver, coloured by a yellow varnish, on the same principle with the laquered frames of pictures, &c. which were formerly in use. It is an important manufacture, as the leather ornamented in this manner, not only admits of great variety of designs in embossed work, resembling either gilding or silver; but also of the addition of paintings of almost every sort. The manner of performing this kind of leather gilding is as follows.—The skins are first procured in a dry state, after the common dressing and tanning. Those most proper for this purpose, are such as are of a firm close texture; on which account, calf, or goat skins are preferable to sheep. But in that condi-

tion they are too hard and stiff for gilding in this way. In order therefore to soften them, they are first put for some hours in a tub of water, where they are, during such time, to be frequently stirred about with a strong stick. They are then taken out; and, being held by one corner, beaten against a flat stone. They are next made smooth, by spreading them on the stone, and rubbing them strongly over by an iron instrument resembling a blade, but with the lower edge formed round, and the upper edge set in a wooden handle, passing horizontally the whole length of the blade. This instrument the workman slides on the surface of the skin as it lies on the stone, at the same time pressing and leaning on it with all his weight. When one of the skins is finished, another is laid over it, and treated in the same manner; and the others over that. The skins being thus prepared, are joined together, to form pieces of the size required for any particular purpose. In order to their joining properly, they are cut into a square, or rather oblong square form. To which end, a ruler or square is used, or the skins are placed on a table or block, corresponding in size and figure to a wooden print of the kind we shall have occasion to speak of below, and as much of the skin is taken off, as leaves it of the form and dimensions of the table or block. Any defective parts, or holes in the skin, are then to be made good; which is done by paring away with a penknife, half the thickness of the skin for some little space round the hole, or defective part; putting a patch, or correspondent piece of the same kind of skin over it. This patch, or piece, is to have a margin pared to have the thickness, to suit the pared part of the skin; and is then to be fixed in its place, by means of size made of parchment, or gloves cuttings, in the manner described before. After the skins are thus prepared, the next operation is the sizing them, which is done by means of a soft glue, or stiff size, that answers to the gold size, used in other kinds of gilding or silvering, prepared from parchment, or glovers cuttings. This is, in fact, the same with that directed to be used for joining the pieces; only it must be reduced by a longer boiling to a thicker consistence, which should be that of a very stiff jelly. To size a skin or piece, the workman takes a piece of the size of the bigness of a nut; which, however, he does not use whole, but cuts into two parts. With one of these parts, he rubs all the skin, or piece of leather, strongly; and when it is, by this means, spread over the whole surface of the leather, he rubs it with the palm of his hand to disperse it more equally, and uniformly over every part. To the effecting this end, the heat of the hand contributes as well as the motion: as it melts the size to a certain degree of fluidity, and renders it consequently more capable

of being diffused over the whole surface. The workman then leaves the skin for some time to dry, and afterwards spreads the other part of the size on it, in the same manner as the first; which finishes the operation of sizing. It is neccessary to allow some space of time betwixt the laying on the two parts of the size. For if the whole was laid on together; or the first part before the other was dry to a certain degree, the whole would dissolve, and be forced forwards before the hand, instead of being spread by it. In the prosecution of this business, the workman therefore, as soon as he has spread the first part of the size, takes another skin, and treats it in the same manner; which fills up the interval of time, proper for drying the first, he returns then to that, and puts on the other parts of the size, and by this alternative treatment of them, employs the whole of his time without any loss, by waiting till either be dry. The side of the skin on which the hair grew, or what is called the *grain* of the leather, is always chosen for receiving the size and silver. This is necessary to be observed: because that side is evener, and of a closer texture than the other. The skins, being thus sized, are ready for receiving the leaves of silver: which are thus laid on. The workman, who silvers them, stands before a table; on which he spreads two skins before they are dry after the sizing. On the same table, on the right hand, he puts also a large book of leaf silver on a board, which near one end of it has a peg sufficiently long to raise it in such manner, as to make it slope like a writing desk. The book being thus placed, he takes out one by one the leaves of silver, and lays them on the skin previously sized as above. This he does by means of a small pair of pincers, formed by two little rods of wood fastened together at one end, and glued to a small piece of wood cut into the form of a triangle, intended to keep the ends of the two rods at a distance from each other; and to make them answer the purpose, when pressed by the fingers, of taking hold of the leaves of silver. On the side of the piece in which the rods are joined to form the pincers, there is put a kind of tuft, or small brush, of an irregular form, made of foxes, or any other kind of soft hair. With these pincers, the workman takes hold of one of the leaves in the book, and puts it on a piece of cartoon, larger than the leaf, of a figure nearly square; and which has the corners of the end, that is to be placed in the hand of the workman, bent. This piece of cartoon is called a pallet. The workman takes it in his left hand, and, having put on it a leaf of silver, he turns it downward; and lets the leaf fall on the skin, spreading it as much as he can, and bringing, as near as possible, the sides of it, to be parallel to those of the square of leather, or skin. If it happen, that any part of it gets

double, or is not duly spread, he sets it right; raises it sometimes, and puts it in its place, or rubs it gently with the kind of brush, or hair pencil which is at the end of the pincers. But most generally, the workman only lets the leaf fall in its place, spread out on the surface of the leather, without either touching or pressing it; except in the case we shall mention below. After he has done with this leaf, he lays a new one in the same line, and continues the same till such line be complete. He then begins close to the edge of this row of leaves, and forms another in the same manner; and goes on thus, till the whole skin be entirely covered with the leaf silver. This work is very easily and readily performed; as the leaves, which are of a square form, are put on a plain surface, which is also rectangular. The skin being thus covered with the silver, the workman, takes a fox's tail, made into the form of a ball at the end, and uses it to settle the leaves, by pressing and striking them, to make them adhere to the size, and adopt themselves exactly to the places they are to cover. He afterwards rubs the whole surface gently with the tail, without striking, which is done to take off the loose and redundant parts of the silver, and at the same time to move them to those places of the surface, where there was before any defect of the silver; and where, consequently, the size being bare, these will now take. The rest of the loose silver is brushed forwards to the end of the table, where a bag, or linen cloth is placed to receive it.

The skins, when they are thus silvered, are hung to dry on cords, fixed by the ends to opposite walls, at such height as to suspend the skins out of the way of the workman. To hang them on these cords, a kind of cross is used, formed of a strong stick, with a shorter piece of the same fixed crosswise at the end of it; over which the skin being hung without any doubling and with the silvered side outwards, it is conveyed and transferred to the cord in the same state. The skins are to dry in this condition, a longer or shorter time, according to the season and the weather. In summer, four or five hours is sufficient; or those skins which have been silvered in the morning, may remain till the evening, and those in the evening, till next morning. But in winter a longer time is required, according to the state of the weather. There is no occasion, nevertheless, to wait till they be entirely dry. As they may be put in any back yard or garden exposed to the wind, and the heat of the sun. For this purpose they should be put over two boards joined together, where they must be kept stretched out by means of some nails. But in this case, the silvered side must be next the boards, in order to prevent any dirt from falling on it, and sticking to the size, which would hinder their taking well the burnish, that will be mentioned

below. The heat, and the dryness of the air, must determine, also, the time of their hanging in this state; but experience alone can teach how to judge of this point. It is proper the skin should be free from moisture; but yet, they should retain all their softness; in summer this will happen in a few hours, and they will be then in a condition to be burnished. The burnisher which is used for this purpose, is a flint, of which varions fignres may be allowed, and which must be mounted differently with a handle, according to the difference of the figure. A cylindrical form is often chosen, in which case, one of the ends should be of a round figure, of about an inch and a half diameter, and have the surface extremely smooth; as the polishing is performed with this surface. The flint is fixed in the middle of a piece of wood of a foot length, the whole of which length is necessary to its serving as a handle; or the workman takes hold of it at each end, with each of his hands, those parts being roundish, and the middle being left of a greater thickness, in order to admit of a hole of a proper depth for receiving the flint, so as to keep it quite firm and steady. All the art required in the manner of burnishing is, to rub the leaf silver strongly; for which purpose, the workman applies both hands to the burnisher, dwelling longer on those parts which appear most dull. In order to perform this operation, the skin is pnt and spread even on a smooth stone of a requisite size, placed on a table, where it may be so firm and steady, as to bear all the force of pressure the workman can give in sliding the burnisher backwards and forwards over every part of the skin. It would save a great deal of labour to employ, instead of this method of burnishing, that used by the polishers of glass, and also by the card makers. This method consists in fixing the burnisher at the of a strong crooked stick, of which, the other end is fastened to the ceiling. The stick being so disposed, as to act as a spring, of which the force bears on the skin, it exempts the workman from this part of the labour, and leaves him only that of sliding the burnishers along the skin, in the directions the polishing requires. The objections to this method are, that some parts of the skin require a greater pressure than others, and that sometimes dirt sticking to the size, which passes through the joining of the silver, will scratch the work, if the workman in going along did not see and remove it, which he cannot so well do in using the spring burnisher. But certainly, these inconveniencies have obvious remedies, when they are understood. The using the spring burnisher for the greatest part of the work, does not prevent taking the aid of the common one for finishing, if any parts, that appear imperfectly polished, shall render it necessary; and the workman may well afford the trouble of examining

the skin, and cleansing it thoroughly, by the labour he will save in this way; or, perhaps, it is always best to do this office, before any kind of polishing be begun, rather than to leave it to be done during the polishing. In some manufactures, the burnishing is performed, by passing the silvered skins betwixt two cylindrical rollers of steel, with polished faces. If this be well executed, it must give a considerable brilliance to the silver, and take away all those warpings and inequalities in the leather, which tend to render the silvered surface less equal and shining. The skins or leather, being thus silvered and burnished, are now prepared to receive the yellow laquer or varnish, which gives the appearance of gilding. The perfection of this work depends, obviously, in a great degree, on the colour, and other qualities of the composition used as such varnish; for which different artists in this way have different recipes; each pretending, in general, that his town is best, and making consequently a secret of it. The following is, however, at least equal to any hitherto used; and may be prepared without any difficulty, except some little nicety in the boiling.——"Take of fine white resin four pounds and a half; of common resin the same quantity; of gum sandarac two pounds and a half, and of aloes two pounds. Mix them together, after having bruised those which are in great pieces; and put them into an earthen pot, over a good fire made of charcoal, or over any other fire where there is no flame. Melt all the ingredients in this manner, stirring them well with a spatula, that they may be thoroughly mixed together, and be prevented also from sticking to the bottom of the pot. When they are perfectly melted and mixed, add gradually to them, seven pints of linseed oil, and stir the whole well together with the spatula. Make the whole boil, stirring it all the time, to prevent a kind of sediment, that will form, from sticking to the bottom of the veesel. When the varnish is almost sufficiently boiled, add gradually, half an ounce of lithrage, or half an ounce of red lead; and when they are dissolved, pass the varnish through a linen cloth, or flannel bag."

The time of boiling such a quantity of varnish, may be in general about seven or eight hours. But as the force of the heat, and other circumstances, may vary, it does not permit of any precise rule. The means of judging of this, is by taking a little quantity out of the pot, with a silver spoon, or other such instrument, and touching it with the finger; when, if the varnish appear, on cooling, of the consistence of a thick syrup, become soon after ropy, and then drying, glue the fingers together, and give a shining appearance; it may be concluded, the time of boiling is sufficient. But if these signs are found wanting, the contrary must be inferred;

and the boiling must be continued till they do arise. When the quantity of ingredients is diminished, the time of boiling may be also contracted. A pint of oil, and a correspondent proportion of fine resin and aloes, has produced a varnish perfectly good in an hour and a half. In this process, it is very necessary to have a pot, that will not be half filled with all the ingredients; and also to guard with the greatest caution against any flame coming near the top of the pot, or the vapour, which rises from it during the boiling. For it is of so combustible a nature, it would immediately take fire; and the ingredients themselves would burn in such a manner, as would not only defeat the operation, but occasion the hazard of other inconveniences. The varnish thus prepared, attains a brown appearance; but, when spread on silver, gives it a colour greatly similar to that of gold. If, however, it should not be found, after this proceeding, that the force of yellow was sufficiently strong, an addition of more aloes, must be made before the boiling be discontinued. Care must be taken, nevertheless, in doing this, not to throw in a large lump at once; because such an effervescence is excited, in that case, as would endanger the varnish rising over the edge of the vessel, and producing a flame, that would instantly make the whole take fire. On the other hand, if the varnish seem too strong of the colour, sandaric must be added with the same precaution, which increasing the quantity of varnish, will dilute the colour. The laying the laquer, or varnish on the silvered leather, is performed in the open air: and should be done in summer, when it is hot and dry. It is thus performed: The skins are again to be stretched and fastened with nails to the same boards on which they were before fixed to complete the drying after the silvering; but with this difference, that the silvered side must be outwards. Eighty or twenty skins may be treated thus at the same time; there being two or three on each board. All the boards should be then ranged on tressels parallel to each other, in such manner, that all, both of them and the skins, may be close to each other. Every thing being thus prepared, the principal workman spreads some of the white of eggs over each skin. The use of this is to fill up small inequalities in the surface of the skin; and to prevent the varnish passing through the interstices of the silver, and being absorbed by the leather. Some omit this; and with advantage, if these inconveniencies could be avoided without it; as it renders the varnish more apt to crack and peel off the silver. But where it is omitted, the varnish should be of a thicker consistence; the surface of the leather of a firm dense texture; and the leaves of silver of a greater thickness than the common. When the white of eggs is dry, the workman who lays on the varnish sets it on

the table before him in a pot; being, as before directed, pretty near the consistence of a thick syrup. He then dips the four fingers of one of his hands in the varnish; and uses them as a pencil to spread it on the skin. In doing this, he holds the fingers at a small but equal distance from each other, and putting the ends of them on the skin near one of the edges of it; and he then moves his hands so, that each finger paints a kind of *S* with the varnish, from one end of the skin to the other. He afterwards dips his fingers again in the varnish, and repeats the same operation again on the next part of the skin, till the whole be gone over in the same manner. This might be done with a pencil or proper brush; but the workman finds the using the fingers only, to be the readiest method for distributing the varnish equally over the skin.—After the varnish is thus laid on the skin, it is to be spread; which is still done by the hand solely. The method is to rub the flat of the open hand over every part of the skin on which the varnish has been put by the fingers, and by that means diffuse it evenly over every part. After this, it is to be immediately beaten by strokes of the palms of the hands, which are to be frequently repeated on every part in general, but in a greater degree on those places where the varnish appears to lie thicker than on the rest; and in doing this, both hands are, for dispatch, employed at the same time. When this operation is finished, the skins are still to be left on the boards where they were stretched and nailed; and those boards are, therefore, either continued till that time on the tressels where the varnish was put on the skin; or, if they be wanted for fresh skins, taken off, and fixed up against the wall of the place, or any other proper support. The time of drying depends of course on the heat of the sun and weather; but at a seasonable time does not exceed a few hours. It is to be known, as to each particular parcel of skins, by examining them with the finger. If on touching them, they be found free from any stickiness, or, in the style of workmen, tackiness, or that the finger makes no impression on the varnish, they may be concluded sufficiently dry; and the contrary, when they are found to be otherwise. This coat of varnish being dry, the skins are to be again put on the tressels as before, and another coat laid on exactly in the same manner as the first. In doing this, examination must be made, whether any of the skins appear stronger or weaker coloured than the others; in order that the defect may be now remedied, by making this coat thicker or thinner, as may appear necessary. When this coat is dry, the varnishing for producing the appearance of gilding is completed; and if it has been well performed, the leather will have a very fine gold colour, with a considerable degree of polish or brightness. When there is an inten-

tion to have one part of the leather silver, and the other gold, a pattern is formed on the surface, by printing, chalking, or stamping a design on the surface after the silvering. The skin is then to be varnished, as if the whole were intended to be gold; but after the last coat, instead of drying the varnish, it is to be immediately taken off that part which is intended to be silver, according to the design printed or chalked upon it, by a knife; with which the workman scrapes off all that he can without injuring the silver, and afterwards by a linen cloth, with which all that remains is endeavoured to be wiped or rubbed off. The skins, being thus silvered and varnished, are made the ground of various designs for embossed work and painting. The embossed work or relief is raised by means of printing with a rolling press, such as is used for copper plates; but the design is here to be engraved on wood. The painting may be of any kind; but oil is principally used, as being durable and most easily performed. There is nothing more necessary in this case, than in painting on other grounds, except that, where varnish or water is used, the surface be clean from any oily or greasy matter.

429. *Sympathetic powder.*

The composition of the famous sympathetic powder, used at Gossilaer by the miners in all their wounds, is this. Take of green vitriol, eight ounces; of gum tragacanth, reduced to an impalpable powder, one ounce: mix these together, and let a small quantity of the powder be sprinkled on the wound, and it immediately stops bleeding. The vitriol is to be calcined to whiteness in the sun, before it is mixed with the gum.

430. *The virtues of a crust of bread, eat in a morning fasting; published by an eminent physician.*

In the above treatise, (which sells for 3s. 9d) the author only asserts, that a great many obstinate disorders, are cured by this simple remedy; and gives many instances of its great efficacy in the following cases, viz. king's evil, cachexies, scurvies, leprosies, rheumatic complaints, &c. The author orders about half an ounce of hard crust, or sea biscuit, to be eat every morning fasting, for five or six weeks; and nothing to be taken after it in less than three or four hours.

431. *To purify butter, and make it of a most sweet taste.*

Melt butter with a slow fire in a well glazed earthen vessel which put to fair water, working them well together, and when it is cold take away the curds and the whey at the bot-

tom. Do it again the second time, and if you please, the third time in rose-water, always working them very well together. The butter thus clarified will be as sweet in taste, as the marrow of any beast, and keep a long time, by reason of the great impurity which is removed by this means, the dross being near a quarter of the whole.

432. *To whiten wax.*

Melt it in a pipkin without boiling. Then take a wooden pestle, which steep in the wax two fingers deep, and plunge immediately into cold water to loosen the wax from it, which will come off like sheets of paper. When you have got all your wax out of the pipkin and made into flakes, put it on a clean towel, and expose it in the air on the grass till it is white. Then melt it and strain it through a muslin to take all the dirt out of it, if there be any.

433. *To make white green ivory.*

Boil the Ivory in water and quick lime, till you see it of a good colour.

434. *Fine Glue.*

Ising-glass and common glue soaked over night in good brandy; then dissolve them over a cool fire, and mix with it a little powdered chalk.

435. *Tortoise shell of horn.*

Take good aquafortis, two ounces fine silver, one drachm; let the silver dissolve, and, after you have spotted your horn with wax, strike the solution all over it, let it dry of itself, the colour will be brown or black.

435. *A mixture which may be used for making impressions of any kind, and will grow as hard as a stone.*

Take fine clean sifted ashes, and fine plaister of paris, of each an equal quantity; and temper the mixture, with parchment size, knead it together, and press it down in your moulds.—You may mix it with what colour you please.

436. *To impress figures in imitation of porcelain.*

Calcined and fine pulverised egg shells, worked with gum-arabic and the white of eggs into a dough, pressed in the mould and dried in the sun.

437. *To prepare a mould that need not to be heated to cast metal in.*

Take fine sand, such as the goldsmiths use, mix it with lamp black, as much as you think proper, temper it with rope or lintseed oil. Let your sand be very dry.

438. *Wafers.*

Take fine flour, mix it with glair of eggs, isinglass and a little yeast; mingle the materials; beat them well together, spread the butter, being made thin with gum water, on even tin plates, and dry them in a stove, then cut them out for use.

439. *A gold colour on tin or lead.*

Take saffron, as much as you will, and put it into a strong gum water; add to it a third part of vinegar and let it soak over night; then mix it with a little clarified honey. Stir it well together, and let it boil till it is of the consistence of honey, strain it through a cloth, and it is fit for use.

440. *A water to tin all sorts of metals, but especially Iron.*

Take one ounce of fine pounded sal-ammoniac, and put it into very sour vinegar; and when you would tin iron, wash it first with this vinegar and strew beaten rosin over it, dip it into the melted tin and it will come out with a fine bright lustre.

441. *To make tin flow easy.*

Take rosin and saltpetre, of each an equal qnantity, beat them to powder and strew them upon the tin when in fusion.

442. *Solder for tin.*

Tin and lead, each one ounce, bismuth two ounces, melt these and cast them thin.

443. *To solder horn.*

Take two pieces of horn, made on purpose to meet together, either for handles of knives or razors, or any thing else, lay foils of what colour you please on the inside of one of the horns, then fix the other piece on it, lay a wet linen fillet twice doubled, over the edges; and with a hot iron rub it

over, and it will close and join together as if made in one piece.

444. *Spittle glue.*

Take two ounces isinglass, half an ounce of sugar-candy, half a drachm gum tragant, then take half an ounce of white parchment, pour on it a pint of water and let it boil well; take that water and strain it through a cloth, and pour it over the other two ingredients, mixed with a little rose water; let it boil away above half, then take it off the fire, and cast it in little flat sticks, or any shape you please.

445. *A good water cement.*

Take one part of red lead, two parts of lime, mix them well together, with whites of eggs.

446. *To etch upon either knives or sword blades. To prepare the etch water.*

Take mercury and aquafortis, put them together into a glass, till the mercury is consumed, and it is fit for use.

447. *To make the ground.*

Take three ounces of red lead, one ounce of white lead, half an ounce of chalk, all finely powdered, grind these together with varnish, and annoint your iron therewith; let it dry in the sun, or before a slow fire; and with a needle draw or write with what you please, then etch it with the above prepared water.

448. *To etch a great number of knives together.*

Grind red lead with lintseed oil or varnish, with this wipe your blades all over, let them dry well and harden; then draw on them what you please, and put them at some distance from each other, into a glazed pot; dissolve some vitriol in hot water, pour it over the blades and lute the pot; set it on a gentle cool fire, and let it boil for sometime, and then let it cool; then take your blades out, scrape the red lead off, and you will have the etching to your satisfaction.

449. *To make blue letters on sword blades.*

Take the blade, hold it over a charcoal fire, till it is blue; then with oil colours write upon the blade what you please; let them dry, and when dry, take good strong vinegar; make

it warm, and pour it all over the blade: this will take off the blue colour; then wet your oil colours with fresh water, and it will come off easily, and the letters remain blue.

450. *To make pewter white.*

Melt tin in an iron pan, strew colophini, or rosin, with fine wheat flower mixed together into it, and stir it gently about; this takes off the blackness, and makes it of a fine white colour; if you would have it hard, add to each pound of tin one or two ounces of pulverised regulus of antimony and veneris: this makes it white, hard, and gives it a clear sound.

451. *To cast wood in moulds as fine as Ivory.*

Take fine sawdust, of lime-tree wood, and put it into a clean pan, tie it close up with paper and let it dry by a gentle heat; then beat it in a stone mortar to a fine powder; sift it through a cambric; keep it from dust, then take one pound of fine parchment glue, the finest gum adragant, and gum arabic, of each four ounces, let it boil in clear pump water, and filtre it through a clean rag; then put into it of the said powder of wood; stir it till it becomes of the substance of a thick paste, and set it in a glazed pan in a hot sand; stir it well together and let the rest of the moisture evaporate till it be fit for casting; then pour or mix your colours with the paste, and put in oil of clover or roses, or the like, to give it a scent; you may put in a little beaten amber. Your mould may be pewter or brass; anoint it with oil of almonds; let it stand three or four days to dry; it will be as hard as ivory.

452. *White Varnish for Clock Faces, &c.*

Take of spirits of wine (highly rectified) one pint, which divide into four parts; then mix one part with half an ounce of gum mastich, in a phial by itself; one part of spirits, and half an ounce of gum sandarach in another phial; one part of spirits, and half an ounce of the whitest parts of gum-benjamin. Then mix and temper them to your mind. It would not be amiss to add a little bit of white resin, or clear Venice turpentine, in the mastich bottle; it will assist in giving a gloss. If your varnish prove too strong and thick, add spirits of wine only; if too hard, some dissolved mastich; if too soft, some sandarach or benjamin. No other rule can be given, unless the quality of the gums and the spirits could be ascertained. When you have brought it to a proper temper, warm the silvered plate before the fire (if a clock face, taking care not to melt the wax,) and with a flat camel's-hair pencil, stroke it all over until no white streaks appear. This will preserve silvering many years.

453. *Of the nature of Japan Grounds.*

When a priming is used, the work should first be prepared by being well smoothed with fish skin or glass paper, and being made thoroughly clean, should be brushed over once or twice with hot size, diluted with two thirds water, if it is of the common strength. The priming should then be laid on as even as possible, and should be formed of a size, of a consistency between the common kind and glue, mixed with as much whiting as will give it a sufficient body of colour to hide the surface of whatever it is laid upon, but not more. This must be repeated till the inequalities are completely filled up, and then the work must be cleaned off with Dutch rushes, and polished with a wet rag.

When wood or leather is to be japanned, and no priming is used, the best preparation is to lay two or three coats of coarse varnish, composed in the following manner:—

Take of rectified spirits of wine one pint, and of coarse seed-lac and resin, each two ounces; dissolve the seed-lac and resin in the spirit, and then strain off the varnish.

This varnish, as well as all others formed of spirit of wine, must be laid on in a warm place; and if it can be conveniently managed, the piece of work to be varnished should be made warm likewise; and for the same reason, all dampness should be avoided; for either cold or moisture chills this kind of varnish, and prevents its taking proper hold of the substance on which it is laid.

When the work is so prepared, or by the priming with the composition of size and whiting above described, the proper japan ground must be laid on, which is much the best formed of shell-lac varnish, and the colour desired, except white, which requires a peculiar treatment; and if brightness be wanted, then also other means must be pursued.

The colours used with the shell-lac varnish may be any pigments whatever, which give the tint of the ground desired.

As metals never require to be under coated with whiting, they may be treated in the same manner as wood or leather.

454. *White Japan Grounds.*

The forming a ground perfectly white, and of the first degree of hardness, remains hitherto a desideratum in the art of japanning, as there are no substances which form a very hard varnish, but which have too much colour not to injure the whiteness, when laid on of a due thickness over the work.

The nearest approach, however, to a perfect white varnish, already known, is made by the following composition:—

Take flake-white, or white lead, washed over and ground

up with one sixth of its weight of starch and then dried; and temper it properly for spreading with mastich varnish.

Lay these on the body to be japanned, prepared either with or without the under coat of whiting, in the manner as above ordered; and then varnish it over with five or six coats of the following varnish:—

Provide any quantity of the best seed-lac, and pick out of it all the clearest and whitest grains, reserving the more coloured and fouler parts for the coarse varnishes, such as that used for priming or preparing wood or leather. Take of this pickled lac two ounces, and of gum animi three ounces; and dissolve them, being previously reduced to a gross powder, in about a quart of spirits of wine, and strain off the clear varnish.

The seed lac will give a slight tinge to this composition; but it cannot be omitted, where the varnish is wanted to be hard; though, when a softer will answer the end, the proportion may be diminished, and a little crude turpentine added to the gum animi to take off the brittleness.

A very good varnish, entirely free from all brittleness, may be formed by dissolving as much gum animi as the oil will take, in old nut or poppy oil; which must be made to boil gently when the gum is put into it. The ground of white colour itself may be laid on in this varnish, and then a coat or two of it may be put over the ground; but it must be well diluted with oil of turpentine when it is used. This, though free from brittleness, is nevertheless liable to suffer by being indented or bruised by any slight strokes; and it will not well bear any polish, but may be brought to a very smooth surface without, if it be judiciously managed in the laying it on. It is likewise somewhat tedious in drying, and will require some time where several coats are laid on; as the last ought not to contain much oil of turpentine.

455. *Blue Japan Grounds.*

Blue Japan grounds may be formed of bright Prussian-blue; or of verditer, glazed over by Prussian blue, or smalt. The colour may be best mixed with shell-lac varnish, and brought to a polishing state by five or six coats of varnish of seed-lac; but the varnish, nevertheless, will somewhat injure the colour, by giving to a true blue a cast of green, and fouling in some degree a warm blue by the yellow it contains; where, therefore, a bright blue is required, and a less degree of hardness can be dispensed with, the method before directed in the case of white grounds, must be pursued.

456. *Red Japan Grounds.*

For a scarlet japan ground, vermilion may be used; but the vermilion has a glaring effect, that renders it much less beautiful than the crimson produced by glazing it over with carmine or fine lake, or even with rose pink, which has a very good effect, used for this purpose. For a very bright crimson, nevertheless, instead of glazing with carmine, the Indian lake should be used, dissolved in the spirit of which the varnish is compounded, which it readily admits of when good; and in this case, instead of glazing with the shell-lac varnish, the upper or polishing coats need only be used, as they will equally receive and convey the tinge of the Indian lake, which may be actually dissolved by spirits of wine, and this will be found a much cheaper method than the using carmine. If, however, the highest degree of brightness is required, the white varnish must be used.

457. *Yellow Japan Grounds.*

For bright yellow grounds, king's yellow, or turpeth mineral, should be employed, either alone or mixed with fine Dutch pink, and the effect may be still more heightened, by dissolving powdered turmeric root in the spirits of wine, of which the upper or polishing coat is made, which spirits of wine must be strained from off the dregs before the seed-lac be added to it, to form the varnish.

The seed-lac varnish is not equally injurious here, and with greens, as is the case of other colours; because, being only tinged with a reddish yellow, it is little more than an addition to the force of the colours.

Yellow grounds may be likewise formed of Dutch pink only, which, when good, will not be wanting in brightness, though extremely cheap.

458. *Green Japan Grounds.*

Green grounds may be produced by mixing king's yellow and bright Prussian-blue, or rather turpeth mineral and Prussian-blue. And a cheap, but fouler kind by verdigris, with a little of the above mentioned yellows, or Dutch pink. But where a very bright green is wanted, the crystals of verdigris, called distilled verdigris, should be employed; and to heighten the effect, they should be laid on a ground of leaf gold, which renders the colour extremely brilliant and pleasing.

459. *Orange Japan Grounds.*

Orange coloured japan grounds may be formed by mixing

vermilion, or red lead, with king's yellow, or Dutch pink, or the orange lake, which will make a brighter orange ground than can be produced by any mixture.

460. *Purple Japan Grounds.*

Purple japan grounds may be produced by the mixture of lake and Prussian-blue; of a darker kind, by vermilion and Prussian-blue. They may be treated as the rest, with respect to the varnish.

461. *Black Japan Grounds without heat.*

Black grounds may be formed by either ivory black, or lamp black; but the former is preferable where it is perfectly good. These may always be laid on with shell-lac varnish; and have their upper or polishing coats of common seed-lac varnish, as the tinge or foulness of the varnish can here be no injury.

462. *Common Black Japan Grounds on Iron or Copper, produced by means of heat.*

For forming the black japan grounds by means of heat, the piece of work to be japanned must be painted over with drying oil, and a little lamp black; and when it is of a moderate dryness, must be exposed to such a degree of heat, as will change the oil to black, without burning so as to destroy or weaken its tenacity. The stove should not be too hot when the work is put into it, nor the heat increased too fast, either of which errors would make it blister; but the slower the heat is augmented, and the longer it is continued, provided it be restrained within the due degree, the harder will be the coat of japan. This kind of varnish requires no polish, having received, when properly managed, a sufficient one from the heat.

463. *The fine Tortoise-shell Japan Ground, produced by means of heat.*

The best kind of tortoise-shell ground produced by heat is not less valuable for its great hardness, and enduring to be made hotter than boiling water without damage, than for its beautiful appearance. It is to be made by means of a varnish prepared in the following manner:—

Take of good linseed-oil one gallon, and of umber half a pound; boil them together till the oil become very brown and thick; strain it through a coarse cloth, and set it again to boil; in which state it must be continued till it acquire a pitchy consistence, when it will be fit for use.

Having thus prepared the varnish, clean well the iron or copper plate, or other pieces which are to be japanned, and then lay vermilion tempered with shell-lac varnish, or with drying oil diluted with oil of turpentine, very thinly, on the places intended to imitate the more transparent parts of the tortoise-shell. When the vermilion is dry, brush over the whole with the black varnish, tempered to a true consistence with oil of turpentine; and when it is set and firm, put the work into a stove, where it may undergo a very strong heat, and must be continued a considerable time; if even three weeks or a month, it will be the better.

This was given amongst other receipts by KUNCKEL; but appears to have been neglected till it was revived with great success in the Birmingham manufactures, where it was not only the ground of snuff boxes, dressing boxes, and other such lesser pieces; but of those beautiful tea waiters which have been so justly esteemed and admired in several parts of Europe, where they have been sent. This ground may be decorated with painting and gilding, in the same manner as any other varnished surface, which had best be done after the ground has been duly hardened by the hot stove; but it will be best to give a second annealing with a more gentle heat, after it is finished.

464. *Manner of varnishing Japan Work.*

The finishing of japan work lies in the laying on, and polishing, the outer coats of varnish which are necessary, as well in the pieces that have only one simple ground of colour, as with those that are painted. This is in general done best with common seed-lac varnish, except in the instances, and on those occasions, where we have already shewn other methods to be more expedient; and the same reasons which decide as to the fitness or impropriety of the varnishes, with respect to the colours of the ground, hold equally with regard to those of the painting. For where brightness is the most material point, and a tinge of yellow will injure it, seed-lac must give way to the whiter gums; but where hardness, and a greater tenacity, are most essential, it must be adhered to; and where both are so necessary, that it is proper one should give way to the other in a certain degree reciprocally, a mixed varnish must be adopted.

This mixed varnish, as we have already observed, should be made of the picked seed-lac. The common seed-lac varnish, which is the most useful preparation of the kind hitherto invented, may be thus made:—

Take of seed-lac three ounces, and put it into water, to free it from the sticks and filth that are frequently intermix-

ed with it; and which must be done by stirring it about, and then pouring off the water, and adding fresh quantities, in order to repeat the operation, till it be freed from all impurities, as is very effectually done by this means. Dry it then, and powder it grossly, and put it, with a pint of rectified spirit of wine, into a bottle, of which it will not fill above two thirds. Shake the mixture well together, and place the bottle in a gentle heat, till the seed-lac appears to be dissolved; the shaking being in the mean time repeated as often as may be convenient: and then pour off all that can be obtained clear by this method, and strain the remainder thro' a coarse cloth. The varnish thus prepared must be kept for use in a bottle well stopped.

When the spirit of wine is very strong, it will dissolve a greater proportion of the seed-lac; but this quantity will saturate the common, which is seldom of a strength sufficient to make varnishes in perfection. As the chilling, which is the most inconvenient accident attending varnishes of this kind, is prevented, or produced more frequently, according to the strength of the spirit; we shall therefore take this opportunity of shewing a method by which weaker rectified spirits may with great ease at any time be freed from the phlegm, and rendered of the first degree of strength.

Take a pint of the common rectified spirit of wine, and put it into a bottle, of which it will not fill above three parts; add to it half an ounce of pearl-ashes, salt of tartar, or any other alkaline salt, heated red hot, and powdered as well as it can be without much loss of its heat. Shake the mixture frequently for the space of half an hour; before which time, a great part of the phlegm will be separated from the spirit, and will appear, together with the undissolved part of the salts, in the bottom of the bottle. Let the spirit be poured off, or freed from the phlegm and the salts, by means of a tritorium, or separating funnel; and let half an ounce of the pearl-ashes, heated and powdered as before, be added to it, and the same treatment repeated. This may be done a third time, if the quantity of phlegm separated by the addition of the pearl-ashes appear considerable. An ounce of alum reduced to powder, and made hot, but not burnt, must then be put into the spirit, and suffered to remain some hours, the bottle being frequently shaken; after which the spirit being poured off from it, will be fit for use.

The addition of the alum is necessary to neutralize the remains of the alkaline salt, which would otherwise greatly deprave the spirit, with respect to varnishes and lacquer where vegetable colours are concerned, and must consequently render another distillation necessary.

The manner of using the seed-lac, or white varnish, is the

same, except with regard to the substance used in polishing; which, where a pure white of a great clearness of other colours is in question, should be itself white; whereas the browner sorts of polishing dust, as being cheaper, and doing their business with greater dispatch, may be used in other cases. The pieces of work to be varnished, should be placed near a fire, or in a room where there is a stove, and made perfectly dry; and then the varnish may be rubbed over them by the proper brushes made for that purpose, beginning in the middle, and passing the brush to one end, and then with another stroke from the middle, passing it to the other. But no part should be crossed, or twice passed over, in forming one coat, where it can be possibly avoided. When one coat is dry, another must be laid over it; and this must be continued at least five or six times, or more, if, on trial, there be not sufficient thickness of varnish to bear the polish, without laying bare the painting or ground colour underneath.

When a sufficient number of coats is thus laid on, the work is fit to be polished; which must be done, in common cases, by rubbing it with a rag, dipped in tripoli, or rotten-stone, finely powdered; but, towards the end of the rubbing, a little oil of any kind should be used along with the powder; and when the work appears sufficiently bright and glossy, it should be well rubbed with the oil alone, to clean it from the powder, and give it a still brighter lustre.

In case of white grounds, instead of tripoli, or rotten stone, fine putty, or whiting, must be used; both of which should be washed over, to prevent the danger of damaging the work, from any sand or gritty matter that may happen to be mixed with them.

It is a great improvement in all kinds of japan work, to harden the varnish by means of heat; which in every degree that it can be applied, short of what would burn or calcine the matter, tends to give it a more firm and strong texture.

Where metal forms the body, a very hot stove may be used; and the pieces of work may be continued in it a considerable time, especially if the heat be gradually increased; but where wood is in question, heat must be sparingly used, as it would otherwise warp or shrink the body, so as to injure the general figure.

465. *MANUFACTURE OF GLASS.*

This beautiful material is not of modern invention; it was known to the ancient Romans, but it was by no means common among them, and they do not appear to have had the method of forming it into vessels of various shapes as is practised at present.

Glass is made by fusing together silex and potash, or soda, in proper proportions. Sea sand, which consists almost entirely of quartz and flints reduced to powder, is generally used for this purpose. The alkali is generally procured from the burning of sea weeds; these are cut, dried, and burned in pits dug in the ground; after a sufficient quantity of them have burned in the same pit, a melted or liquid mass is found in the bottom, which, after being well stirred, is suffered to cool; it is then called *kelp*, and consists of a mixture of soda, potash, and parts of half burnt weeds, together with shells, sand, and other impurities.

When the ingredients of which glass is composed are perfectly fused, and have acquired a certain degree of heat, which is known by the fluidity of the mass, part of the melted matter is taken out at the end of a long hollow tube, which is dipped into it, and turned about, till a sufficient quantity is taken up; the workman then rolls it gently upon a piece of iron, to unite it more intimately. He then blows through the tube, till the melted mass at the extremity swells into a bubble, after which he rolls it again on a smooth surface to polish it, and repeats the blowing, until the glass is brought as near the size and form of the vessel required as he thinks necessary.

If it be a *common bottle*, the melted glass at the end of the tube is put into a mould of the exact size and shape of its body, and the neck is formed on the outside, by drawing out the ductile glass.

If it be a vessel with a *wide orifice*, the glass in its melted state is opened and widened with an iron tool; after which being again heated, it is whirled about with a circular motion, and by means of the centrifugal force thus produced, is extended to the size required. Should a handle, foot, or any thing else of the kind, be required, these are made separately, and stuck on in its melted state.

Window Glass is made in a similar manner, except that the liquid mass at the end of the tube is formed into a cylindrical shape, which being cut longitudinally by scissars or sheers, is gradually bent back until it becomes a flat plate.

Large plate glass, for looking glasses, &c. is made by suffering the mass in a state of complete fusion to flow upon a table, with iron ledges to confine the melted matter, and as it cools, a metallic roller is passed over it, to reduce it to an uniform thickness. There are various kinds of glass manufactured for different purposes; the principal of these are flint glass, crown glass, and bottle green.

Flint glass is the densest, most transparent, colourless, and beautiful. It is sometimes called *crystal*. The best kind is said to be manufactured in London, from 120 parts of white

siliceous sand, 40 parts of pearl-ash, 35 of red oxyde of lead, 13 of nitrate of potash, and 25 of black oxyde of manganese. It is the most fusible glass. It is used for bottles, and other utensils, intended to be cut and polished, and for various ornamental purposes.

Crown glass differs from the last, in containing no lead. It is made of soda and fine sand. It is used for panes of windows, &c.

Bottle glass is the coarsest sort of all. It is made from kelp and common sand. Its green colour is owing to iron. It is the least fusible.

Glass is sometimes coloured by mixing with it while in a fluid state, various metallic oxydes. It is coloured *blue*, by the oxyde of cobalt; *red*, by the oxyde of gold; *green*, by the oxyde of copper or iron; *yellow*, by the oxyde of silver or antimony, and *violet* by the oxyde of manganese

The hardness of glass is very considerable; its specific gravity varies from 2, 8 to 4, according to the quantity of metallic oxyde which enters into its composition. Though glass, when cold, is brittle, it is one of the most ductile bodies known. When liquid, if a thread of melted glass be drawn out, and fastened to a reel, the whole of the glass can be spun off; and by cutting the threads of a certain length, there is obtained a sort of feather of glass. A thread of glass may be thus drawn or spun so fine, as to be scarcely visible to the naked eye. Glass is almost perfectly elastic, and is one of the most sonorous bodies. Fluoric acid dissolves it at common temperatures, and alkalis in a great degree of heat. These are the only substances known which act upon it.

Glass utensils require to be gradually cooled in an oven: this operation is called *annealing*, and is necessary to prevent their breaking by change of temperature, wiping, or slight accidental scratches.

Two toys are made of unannealed glass, which, though commonly used for the amusement of children, exhibit phenomena which justly interest the curiosity of the philosopher; we mean Prince RUPERT's drops, and the Bologna flask, or philosophical phial.

Prince Rupert's drops are made, by letting drops of melted glass fall into cold water: the drop assumes by that means an oval form, with a tail or neck resembling a retort. These drops are said to have been first invented by Prince RUPERT, and are therefore called by his name. They possess this singular property, that if a small portion of the tail is broken off, the whole bursts into powder, with an explosion; and a considerable shock is communicated to the hand that grasps it.

The *Bologna* or *philosophical phial*, is a small vessel of glass, which has been suddenly cooled, open at the upper end, and

rounded at the bottom. It is made so thick at the bottom, that it will bear a smart blow against a hard body, without breaking; but if a little pebble, or piece of flint, is let fall into it, it immediately cracks, and the bottom falls into pieces: but unless the pebble or flint is large and angular enough to scratch the surface of the glass, it will not break.

The most generally received explanation of these facts is founded on the assumption, that the dimensions of those bodies which are suddenly cooled, are larger than those which are more gradually cooled. The dimensions, therefore, of the smooth external surface of these glasses which are suddenly cooled, are supposed to be larger than is adapted to the accurate envelopement of the internal part, which is necessarily cooled in a more gradual manner; if, therefore, by a crack or scratch, a disjunction of the cohesion takes place, in the internal surface, the hidden action of the parts which remained in a state of tension, to recover that of perfect cohesion, is supposed to effect the destruction of the mass.

466. *BREWING.*

The art of brewing, or of preparing a vinous fermented liquor from farinaceous seeds, is very ancient. It was known to the ancient Egyptians, Germans, Spaniards, Gauls, and the inhabitants of the British Isles, and the north of Europe. The liquor made by them, however, resembled more our sweet and mucilaginous ales, the use of hops being of modern invention.

The vinous fermentation cannot be produced without saccharine matter; and any substance containing sugar is capable of producing ardent spirit, or alkohol.

Barley is a grain consisting of fecula or starch, albumen, and a little gluten; and by the process of malting, its fecula is converted into sugar: hence it affords a convenient material for the production of alkohol, which is the substance that gives the intoxicating quality to every liquor.

Malting, or the converting barley into malt, is the first process in the making of beer. To effect this, the grain is put into a trough with water, to steep for about three days: it is then laid in heaps, to let the water drain from it, and afterwards turned over and laid in new heaps. In this state, the same process takes place as if the barley were sown in the ground. It begins to germinate, puts forth a shoot, and the fecula of the seed is converted into saccharine matter. When this is sufficiently accomplished, which is known by the length of the shoot, (about two-thirds of the length of the grain,) this process of germination must be stopped, otherwise the sugar would be lost, nature intending it for the nourishment

of the young plant. The malt is therefore spread out upon a floor, and frequently turned over, which cools it, and dries up its moisture, without which the germination cannot proceed. When it is completely dried, in this manner, it is called *air dried* malt, and is very little altered in colour. But when it is dried in kilns, it acquires a brownish colour, which is deeper in proportion to the heat applied; it is then called *kiln dried*. This malt is then coarsely ground in a mill.

Mashing is the next step in the process of brewing. This is performed in a large circular wooden vessel, called the mash tun, shallow in proportion to its extent, and furnished with a false bottom, pierced with small holes, and fixed a few inches above the real bottom. There are two side openings, in the interval between the real and false bottom: to one is fixed a pipe, for the purpose of conveying water into the tun, and the other for drawing the liquor out of it. The malt is to be strewed evenly over the false bottom of the same tun, and then, by means of the side pipe, a proper quantity of hot water is introduced from the upper copper. The water rises upwards through the malt, or as it is called the *grist*, and when the whole quantity is introduced, the mashing begins, the object of which is to effect a perfect mixture of the malt with the water, so that the soluble parts may be extracted by it: for this purpose, the grist is sometimes incorporated with the water by iron rakes, and then the mass is beaten and agitated by long flat wooden poles, resembling oars, which are either worked by the hand or by machinery.

When the mashing is completed, the tun is covered in, to prevent the escape of the heat, and the whole is suffered to remain still, in order that the insoluble parts may separate from the liquor: the side is then opened, and the clear wort allowed to run off, slowly at first, but more rapidly as it becomes fine, into the lower or boiling copper.

The chief thing to be attended to in mashing, is the temperature of the mash, which depends on the heat of the water, and the state of the malt. If the water was let in upon the grist boiling hot, the starch which it contains would be dissolved, and converted into a gelatinous substance, in which all the other parts of the malt, and most of the water, would be entangled beyond the possibility of being recovered by any after process.

The most eligible temperature appears to be from 185° to 190° of Fahrenheit; for the first mashing, the heat of the water must be somewhat below this temperature, and lower in proportion to the dark colour of the malt made use of. For pale malt the water may be 180°, but for brown it ought not to be more than 170°.

The liquor or *wort* (as it is called,) of the first mashing is

always by much the richest in saccharine matter; but to exhaust the malt, a second and third mashing is required, in which the water may be safely raised to 190° or upwards.

The proportion of wort to be obtained from each bushel of malt, depends entirely on the proposed strength of the liquor. It is said that 25 or 30 gallons of good table beer may be taken from each bushel of malt. For ale and porter of the superior kinds, only the produce of the first mashing, or six or eight gallons, is to be employed.

Brewers make use of an instrument called a *sacchrometer*, to ascertain the strength and goodness of the wort. This instrument is a kind of hydrometer, and shews the specific gravity of the wort, rather than the exact quantity of saccharine matter which it contains.

The next process in brewing is the *boiling* and *hopping*. If only one kind of liquor is made, the produce of the three mashings is to be mixed together; but if ale and table beer are required, the wort of the first, or first and second mashings is appropriated to the ale, and the remainder is set aside for the beer.

All the wort destined for the same liquor, after it has run from the tun, is transferred to the large lower copper, and mixed with a certain proportion of *hops*. The better the wort, the more hops are required. In private families a pound of hops is generally used to every bushel of malt; but in public breweries, a much smaller proportion is deemed sufficient. When ale and table beer are brewed from the same malt, the usual practice is to put the whole quantity of hops in the ale wort, which having been boiled some time, are to be transferred to the beer-wort, and with it to be again boiled.

When the hops are mixed with the wort in the copper, the liquor is made to boil, and the best practice is to keep it boiling as fast as possible, till upon taking a little of the liquor out, it is found to be full of small flakes like that of curdled soap. The boiling copper is in common breweries uncovered; but in many, on a large scale, it is fitted with a steam-tight cover, from the centre of which passes a pipe, that terminates by several branches in the upper or mashing copper. The steam therefore produced by the boiling, instead of being wasted, is let into the cold water, and thus raises it very nearly to the temperature required for mashing, besides impregnating it very sensibly with the essential oil of the hops, in which the flavour resides.

When the liquor is boiled, it is discharged into a number of *coolers*, or shallow tubs, in which it remains until it becomes sufficiently cool to be submitted to fermentation. It is necessary that the process of cooling should be carried on as ex-

peditiously as possible, particularly in hot weather; and for this reason, the coolers in the brew-houses are very shallow. Liquor made from pale malt, and which is intended for immediate drinking, need not be cooled lower than 75° or 80°; of course this kind of beer may be brewed in the hottest weather; but beer brewed from brown malt, and intended to be kept, must be cooled to 65° or 70° before it is put into a state of fermentation. Hence in the spring, the month of March, and in autumn, the month of October, have been deemed the most favourable for the manufacture of the best malt liquor.

The last operations in brewing are the *tunning* and *barrelling*. From the coolers the liquors is to be transferred into the working tun, and with it is to be mixed a gallon of yeast to four barrels of beer, in order to excite the vinous fermentation. In four or five hours the fermentation begins, and it requires from 18 or 20 hours to 48, before the wort is fit to be put into the barrels. In the barrels the fermentation again goes on, and, during a few days, a copious discharge of yeast takes place from the bung hole; when care must be taken that the barrels are filled every day with fresh liquor: this discharge gradually becomes less, and in about a week it ceases: in which time the bung hole is closed, and the liquor is fit for use after it has stood a certain time, according to its strength, and the temperature at which it has been fermented.

For *ales*, the paler kinds of malt are used, and little hops, as they are required not to taste bitter. But for *porter*, the brown malts are used, and a larger quantity of hops. It is bad economy to use malts that are very highly dried, as the deepening of the colour is owing to a part of the saccharine matter being carbonized. A dark colour may be procured more economically by burnt sugar. Hops are added to ale or beer, because they afford a resinous, aromatic matter, which is requisite to correct insipidity and sweetness, and to render the liquor capable of preservation for a due length of time. It is in Great Britain prohibited by law to use any substance in brewing, as a substitute for hops.

467. *DYEING.—Principles of Dyeing.*

The substances commonly employed for clothing may be reduced to four, viz. wool, silk, cotton, and linen.

Permanent alterations in the colour of cloth can only be induced two ways; either by producing a chemical change in the cloth, or by covering its fibres with some substance which possesses the wished for colour. Recourse can seldom or never to be had to the first method, because it is hardly possible to produce a chemical change in the fibres of cloth

without spoiling its texture and rendering it useless. The dyer, therefore, when he wishes to give a new colour to cloth, has always recourse to the second method.

The substances employed for this purpose are called *colouring matters*, or *dye stuffs*. They are for the most part extracted from animal and vegetable substances, and have usually the colour which they intend to give to the cloth. Since the particles of colouring matter with which cloth when dyed is covered, are transparent, it follows, that all the light reflected from dyed cloth must be reflected, not by the dye stuff itself, but by the fibres of the cloth below the dye stuff. The colour therefore does not depend upon the dye alone, but also upon the previous colour of the cloth. If the cloth be *black*, it is clear that we cannot dye it any other colour whatever; because as no light in that case is reflected, none can be transmitted, whatever dye stuff we employ. If the cloth were red, or blue, or yellow, we could not dye it any colour except black; because, as only red, or blue, or yellow rays were reflected, no other could be transmitted. Hence the importance of a fine white colour, when cloth is to receive bright dyes. It then reflects all the rays in abundance, and therefore any colour may be given, by covering it with a dye stuff which transmits only some particular rays.

If the colouring matters were merely spread over the surface of the fibres of cloth by the dyer, the colours produced might be very bright, but they could not be permanent; because the colouring matter would be very soon rubbed off; and would totally disappear whenever the cloth was washed, or even barely exposed to the weather. The colouring matter then, however perfect a colour it possesses, is of no value, unless it also adheres so firmly to the cloth that none of the substances usually applied to cloth, in order to clean it, &c. can displace it. Now this can only happen, when there is a strong *affinity* between the colouring matter and the cloth, and when they are actually combined together in consequence of that affinity.

Dyeing then is merely a chemical process, and consists in combining a certain colouring matter with fibres of cloth. This process can in no instance be performed, unless the dye stuff be first reduced to its integrant particles; for the attraction of aggregation between the particles of dye stuffs, is too great to be overcome by the affinity between them and the cloth, unless they could be brought within much smaller distances than is possible while they both remain in a solid form. It is necessary, therefore, previously to dissolve the colouring matter in some liquid or other, which has a weaker affinity for it than the cloth has. When the cloth is dipped into this solution, the colouring matter, reduced by this contrivance

to a liquid state, is brought within the attracting distance; the cloth therefore acts upon it, and from its stronger affinity takes it from the solvent, and fixes it upon itself. By this contrivance too, the equality of the colour is in some measure secured, as every part of the cloth has an opportunity of attracting to itself the proper proportion of colouring particles.

The facillity with which cloth imbibes a dye, depends upon two things; viz. the affinity between the cloth and the dye stuff, and the affinity between the dye stuff and its solvent. It is directly as the former, and inversely as the latter. It is of importance to preserve a due proportion between these two affinities, as upon that proportion much of the accuracy of dyeing depends. If the affinity between the colouring matter and the cloth be too great, compared with the affinity between the colouring matter and the solvent, the cloth will take the dye too rapidly, and it will be scarcely possible to prevent its colour from being unequal. On the other hand, if the affinity between the colouring matter and the solvent be too great, compared with that between the colouring matter and the cloth, the cloth will either not take the colour at all, or it will take it very slowly and very faintly.

Wool has the strongest affinity for almost all colouring matters, silk the next strongest, cotton a considerably weaker affinity, and linen the weakest affinity of all. Therefore, in order to dye cotton or linen, the dye stuff should in many cases be dissolved in a substance for which it has a weaker affinity than for the solvent employed in the dyeing of wool or silk. Thus we may use oxyde of iron dissolved in sulphuric acid, in order to dye wool; but for cotton and linen, it is better to dissolve it in acetous acid.

Were it possible to procure a sufficient number of colouring matters, having a strong affinity for cloth, to answer all the purposes of dyeing, that art would be exceedingly simple and easy. But this is by no means the case; if we except indigo, the dyer is scarcely possessed of a dye stuff which yields of itself a good colour, sufficiently permanent to deserve the name of a dye.

This difficulty, which at first sight appears insurmountable, has been obviated by a very ingenious contrivance. Some substance is pitched upon, which has a strong affinity, both for the cloth and the colouring matter. This substance is previously combined with cloth, which is then dipped into the solution containing the dye stuff. The dye stuff combines with the intermediate substance, which being firmly combined with the cloth, secures the permanence of the dye. Substances employed for this purpose are denominated *mordants*.

The most important part of dyeing is undoubtedly the proper choice, and the proper application of mordants, as upon them, the permanency of almost every dye depends. Every thing which has been said respecting the application of colouring matters, applies equally to the application of mordants. They must be previously dissolved in some liquid, which has a weaker affinity to them than the cloth has, to which they are to be applied; and the cloth must be dipped, or even steeped in this solution, in order to saturate itself with the mordant.

Almost the only substances used as mordants, are earths, metallic oxydes, tan, and oil.

Of earthy mordants the most important, and most generally used, is alumine. It is used either in the state of common alum, in which it is combined with sulphuric acid, or in that of acetite of alumine.

Alum, when used as a mordant, is dissolved in water, and very frequently a quantity of tartar is dissolved along with it. Into this solution the cloth is put, and kept in it till it has absorbed as much alumine as is necessary. It is then taken out, and for the most part washed and dried. It is now a good deal heavier than it was before, owing to the alumine which has combined with it. The tartar serves two purposes; the potash which it contains, combines with the sulphuric acid of the alum, and thus prevents that very corrosive substance from injuring the texture of the cloth, which otherwise might happen: the tartareous acid, on the other hand, combines with part of the alumine, and forms a tartrite of alumine, which is more easily decomposed by the cloth than alum.

Acetite of alumine has been but lately introduced into dyeing. This mordant is now prepared by pouring acetite of lead into a solution of alum; a double decomposition takes place, the sulphureous acid combines with the lead, and the compound precipitates, in the form of an insoluble powder, while the alumine combines with the acetous acid, and remains dissolved in the liquid. This mordant is employed for cotton and linen, which have a weaker affinity than wool for alumine. It answers much better than alum; the cloth is more easily saturated with alumine, and takes, in consequence, both a richer and a more permanent colour.

Besides alumine, *lime* is sometimes used as a mordant. Cloth has a strong affinity enough for it; but, in general, it does not answer so well, as it does not give so good a colour. When used, it is either in the state of lime-water, or of sulphate of lime dissolved in water.

Almost all the metallic oxydes have an affinity for cloth, but only two of them are extensively used as mordants, viz. the oxydes of tin, and of iron.

The oxyde of tin was first introduced into dyeing by KUSTER, a German chemist, who brought the secret to London in 1543. This period forms an æra in the history of dyeing. The oxyde of tin has enabled the moderns greatly to surpass the ancients in the fineness of their colours; by means of it alone, *scarlet*, the brightest of all colours, is produced.

Tin, as PROUST has proved, is capable of two degrees of oxydation. The first oxyde is composed of 0.70 parts of tin, and 0.30 of oxygen; the second, or white oxyde, of 0.60 parts of tin, and 0.40 of oxygen. The first oxyde absorbs oxygen with very great facility, even from the air, and is rapidly converted into white oxyde. This fact makes it certain, that it is the white oxyde of tin alone, which is the real mordant; even if the other oxyde were applied to cloth, as it probably often is, it must soon be converted into white oxyde, by absorbing oxygen from the atmosphere.

Tin is used as a mordant in three states: dissolved in nitro muriatic acid, in acetous acid, and in a mixture of sulphuric and muriatic acids. Nitro muriate of tin is the common mordant employed by dyers. They prepare it by dissolving tin in diluted nitric acid, to which a certain proportion of muriate of soda, or of ammonia, is added. Part of the nitric acid decomposes these salts, combines with their base, and sets the muriatic acid at liberty. They prepared it at first with nitric acid alone, but that mode was very defective, because the nitric acid very readily converts tin to white oxyde, and then is capable of dissolving it. The consequence of which was, the precipitation of the whole of the tin. To remedy this defect, common salt, or sal ammoniac, was very soon added; muriatic acid having the property of dissolving white oxyde of tin very readily. A considerable saving of nitric acid might be obtained, by employing as much sulphuric acid as is just sufficient to saturate the base of the common salt, or sal ammoniac employed.

When the nitro muriate of tin is to be used as a mordant, it is dissolved in a large quantity of water, and the cloth is dipped in the solution, and allowed to remain till sufficiently saturated. It is then taken out, washed, and dried. Tartar is usually dissolved in the water along with the nitro muriate. The consequence of this is a double decomposition, the nitro muriatic acid combines with the potash of the tartar, while the tartareous acid dissolves the oxyde of tin. When tartar is used, therefore, in any considerable quantity, the mordant is not a nitro muriate, but a tartrite of tin.

Iron, like tin, is capable of two degrees of oxydation; but the green oxyde absorbs oxygen so readily from the atmosphere, that it is very soon converted into the red oxyde. It is only this last oxyde which is really used as a mordant in

dyeing. The green oxyde is, indeed, sometimes applied to cloth; but it very soon absorbs oxygen, and is converted into the red oxyde. This oxyde has a very strong affinity for all kinds of cloth. The permanency of the iron spots on linen and cotton is a sufficient proof of this. As a mordant, it is used in two states; in that of sulphate of iron, and acetite of iron. The first is commonly used for wool. The salt is dissolved in water, and the cloth dipped in it. It may be used also for cotton, but in most cases acetite of iron is preferred. It is prepared by dissolving iron, or its oxyde, in vinegar, sour beer, &c and the longer it is kept, the more it is preferred. The reason is, that the mordant succeeds best when the iron is in the state of red oxyde. It would be better then to oxydate the iron, or convert it into rust, before using it; which might easily be done, by keeping it for some time in a moist place, and sprinkling it occasionally with water.

Tan has a very strong affinity for cloth, and for several colouring matters; it is therefore very frequently employed as a mordant. An infusion of *nut-galls*, or of *sumach*, or any other substance containing tan, is made in water, and the cloth is dipped in this infusion, and allowed to remain till it has absorbed a sufficient quantity of tan. Silk is capable of absorbing a very great proportion of tan, and by that means acquires a great increase of weight. Manufacturers sometimes employ this method of increasing the weight of silk.

Tan is often employed also, along with other mordants, in order to produce a compound mordant. Oil is also used for the same purpose, in the dyeing of cotton and linen. The mordants with which tan most frequently is combined, are alumine, and oxyde of iron

Besides these mordants, there are several other substances frequently used as auxiliaries, either to facilitate the combination of the mordant with the cloth, or to alter the shade of colour; the chief of these are, *tartar, acetite of lead, common salt, sal ammoniac, sulphate or acetite of copper*, &c.

Mordants not only render the dye permanent, but have also considerable influence on the colour produced. The same colouring matter produces very different dyes, according as the mordant is changed. Suppose, for instance, that the colouring matter be cochineal; if we use the aluminous mordant, the cloth will acquire a crimson colour; but the oxyde of iron produces with it a black.

In dyeing then, it is not only necessary to procure a mordant which has a sufficiently strong affinity for the colouring matter and the cloth, and a colouring matter which possesses the wished for colour in perfection, but we must procure a

mordant and a colouring matter of such a nature, that when *combined together*, they shall possess the wished for colour in perfection. It is evident too, that a great variety of colours may be produced with a single dye stuff, provided we can change the mordant sufficiently.

The colouring matter with which the cloth is dyed, does not cover every portion of its surface; its particles attach themselves to the cloth at certain distances from each other; for cloth may be dyed different shades of the same colour, lighter or darker, merely by varying the quantity of colouring matter. With a small quantity, the shade is light; and it becomes deeper as the quantity increases; now this would be impossible, if the dye stuff covered the whole of the cloth.

That the particles of colouring matter, even when the shade is deep, are at some distance, is evident from this well known fact, that cloth may be dyed two colours at the same time. All those colours to which the dyers give the name of *compound*, are in fact two different colours applied to the cloth at once. Thus cloth gets a *green* colour, by being first dyed *blue* and then *yellow*.

The colours denominated by dyers *simple*, because they are the foundation of all their other processes, are four, viz. first, *blue*; second, *yellow*; third, *red*; fourth, *black*. To these they usually add a fifth, under the name of *root*, or *brown* colour.

468. *Of Dyeing Blue.*

The only colouring matters employed in dyeing blue, are woad, and indigo.

Woad is a plant cultivated in this kingdom, and even growing wild in some parts of England.

Indigo is a blue powder, extracted from a species of plants which is cultivated for that purpose in the East and West Indies. These plants contain a peculiar green pollen, which in that state is solable in water. This pollen has a strong affinity for oxygen, which it attracts greedily from the atmosphere; in consequence of which it assumes a blue colour and becomes insoluble in water.

Indigo has a very strong affinity for wool, silk, cotton, and linen. Every kind of cloth, therefore, may be dyed with it, without the assistance of any mordant whatever. The colour thus induced is very permanent; because the indigo is already saturated with oxygen, and because it is not liable to be decomposed by those substances, to the action of which the cloth is exposed. But it can only be applied to cloth in a state of solution; and the only solvent known being sulphuric acid, it would seem at first sight, that the sulphuric acid

solution is the only state in which indigo can be employed as a dye.

Wool and silk are often dyed blue by the sulphate of indigo; but it can scarcely be applied to cotton and linen, because the affinity of these substances for indigo is not great enough to enable them readily to decompose the sulphate. The colour given by sulphate of indigo is exceedingly beautiful; it is known by the name of Saxon blue.

One part of indigo is to be dissolved in four parts of concentrated sulphuric acid; to the solution one part of dry carbonate of potash is to be added, and then it it is to be diluted with eight times its weight of water. The cloth must be boiled for an hour in a solution, containing five parts of alum, and three of tartar, for every 32 parts of cloth. It is then to be thrown into a water bath, containing a greater or smaller proportion of the diluted sulphate of indigo, according to the shade which the cloth is intended to receive. In this bath it must be boiled till it has acquired the wished for colour.

The alum and tartar are not intended to act as mordants, but to facilitate the decomposition of the sulphate of indigo. The alkali added to the sulphate, answers the same purpose. These substances also, by saturating part of the sulphuric acid, serve in some measure to prevent the texture of the cloth from being injured by the action of the acid, which is very apt to happen in this process.

But sulphate of indigo is by no means the only solution of that pigment employed in dyeing. By far the most common method is, to deprive indigo of the oxygen, to which it owes its blue colour, and thus to reduce it to the state of green pollen; and then to disolve it in water by means of alkalis, or alkaline earths, which in that state act upon it very readily.

Two different methods are employed for this purpose. The first of these methods is, to mix with indigo a solution of some substance which has a stronger affinity for oxygen than the green basis of indigo: green oxyde of iron, for instance, and different metallic sulphurets. If therefore indigo, lime, and green sulphate of iron, be mixed together in water, the indigo gradually loses its blue colour, becomes green, and is dissolved; while the green oxyde of iron is converted into the red oxyde. The manner in which these changes take place is obvious; part of the lime decomposes the sulphate of iron; the green oxyde, the instant that it is set at liberty, attracts oxygen from the indigo, decomposes it, and reduces it to the state of green pollen. This green pollen is immediately dissolved by the action of the rest of the lime.

The second method is, to mix the indigo in water with certain vegetable substances, which readily undergo fermentation. During this fermentation, the indigo is deprived of

its oxygen, and dissolved by means of quick-lime or alkali, which is added to the solution. The first of these methods is usually followed in dyeing cotton and linen; the second, in dyeing wool and silk.

In the dyeing of wool, woad and bran are commonly employed as vegetable ferments, and lime as the solvent of the green base of the indigo. Woad contains itself a colouring matter precisely similar to indigo; by following the common process, indigo may be extracted from it. In the usual state of woad, when purchased by the dyer, the indigo which it contains is probably not far from the state of the green pollen. Its quantity in woad is but small, and it is mixed with a great proportion of other vegetable matter.

When the cloth is first taken out of the vat, it is of a green colour; but it soon becomes blue, by attracting oxygen from the air. It ought to be carefully washed, to carry off the uncombined particles. This solution of indigo is liable to two inconveniences; first, it is apt sometimes to run too fast into the putrid fermentation; this may be known by the putrid vapours which it exhales, and by the disappearing of the green colour. In this state it would soon destroy the indigo altogether. The inconvenience is remedied by adding more lime, which has the property of moderating the putrescent tendency. Secondly, sometimes the fermentation goes on too languidly. This defect is remedied by adding more bran or woad, in order to diminish the proportion of quick-lime.

Silk is dyed light blue by a ferment of six parts of bran, six of indigo, six of potash, and one of madder. To dye it of a dark blue, it must previously receive what is called a ground colour; archil is used for this purpose.

Cotton and *linen* are dyed blue by a solution of one part of indigo, one part of green sulphate of iron, and two parts of quick-lime.

469. *Of Dyeing Yellow.*

The principal colouring matters for dyeing yellow are weld, fustic, and quercitron bark.

Weld is a plant which grows commonly in Great Britain.

Fustic is the wood of a large tree which grows in the West Indies.

Quercitron is a tree growing naturally in North America, the bark of which contains colouring matter.

Yellow colouring matters have too weak an affinity for cloth, to produce permanent colours without the use of mordants. Cloth, therefore, before it be dyed yellow, is always prepared by combining some mordant or other with it. The mordant most commonly employed for this purpose, is alu-

mine. Oxyde of tin is sometimes used when very fine yellows are wanting. Tan is often employed as a subsidiary to alumine, and in order to fix it more copiously on cotton and linen. Tartar is also used as an auxiliary, to brighten the colour; and muriate of soda, sulphate of lime, and even sulphate of iron, in order to render the shade deeper.

The yellow dyed by means of fustic is more permanent, but not so beautiful as that given by weld or quercitron. As it is permanent, and not much injured by acids, it is often used in dyeing compound colours, where a yellow is required. The mordant is alumine. When the mordant is oxyde of iron, fustic dyes a good permanent drab colour.

Weld and quercitron bark yield nearly the same kind of colour; but as the bark yields colouring matter in much greater abundance, it is much more convenient, and, upon the whole, cheaper than weld. It is probable, therefore, that it will gradually supersede the use of that plant. The method of using each of the dye stuffs is nearly the same.

Wool may be dyed yellow by the following process. Let it be boiled for an hour or more with about one-sixth of its weight of alum, dissolved in a sufficient quantity of water. It is then to be plunged, without being rinsed, into a bath of warm water, containing in it as much quercitron bark, as equals the weight of the alum employed as a mordant. The cloth is to be turned through the boiling liquid, till it has acquired the intended colour. Then a quantity of clean powdered chalk, equal to the hundreth part of the weight of the cloth, is to be stirred in, and the operation of dyeing continued for eight or ten minutes longer. By this method a pretty deep and lively yellow may be given fully as permanent as weld yellow.

For very bright orange or golden yellow, it is necessary to have recourse to the oxyde of tin as a mordant.

For producing bright golden yellows, some alum must be added along with the tin.

In order to give the yellow that delicate green shade so much admired for certain purposes, tartar must be added in different proportions, according to the shade.

By adding a small proportion of cochineal, the colour may be raised to a fine orange, or even an aurora.

Silk may be dyed different shades of yellow, either by weld or quercitron bark, but the last is the cheapest of the two. The proportion should be from one to two parts of bark to twelve parts of silk, according to the shade. The bark, tied up in a bag, should be put into the dyeing vessel, while the water which it contains is cold; and when it has acquired the heat of about 100°, the silk, having been previously alumed,

should be dipped in, and continued till it assumes the wished for colour. When the shade is required to be deep, a little chalk or pearlash should be added towards the end of the operation.

Cotton and *linen* are dyed yellow as follows:—

The mordant should be acetite of alumine, prepared by dissolving one part of acetite of lead, and three parts of alum, in a sufficient quantity of water. This solution should be heated to the temperature of 100°, ths cloth should be soaked in it for two hours, then wrung out and dried. The soaking may be repeated, and the cloth again dried as before. It is then to be barely wetted with lime water, and afterwards dried. The soaking in the acetite of alumine may be again repeated, and if the shade of yellow is required to be very bright and durable, the alternate wetting with lime water and soaking in the mordant may be repeated three or four times.

By this contrivance, a sufficient quantity of alumine is combined with the cloth, and the combination is rendered more permanent by the addition of some lime. The dyeing bath is prepared by putting 12 or 18 parts of quercitron bark (according to the depth of the shade required,) tied up in a bag, into a sufficient quantity of cold water. Into this bath the cloth is to be put, and turned round in it for an hour, while its temperature is gradually raised to about 120°; it is then to be brought to a boiling heat, and the cloth allowed to remain in it after that only a few minutes. If it be kept long at a boiling heat, the yellow acquires a shade of brown.

Nankeen yellow is obtained by a solution of the red sulphate of iron, which is combined with the cloth by carbonate of potash.

470. *Of Dyeing Red.*

The colouring matters employed for dyeing red, are kermes, cochineal, archil, madder, carthamus, Brazil-wood, lac, and logwood.

Kermes is a species of insect, affording a red colour by solution in water; but it is not so beautiful as cochineal, which is likewise an insect brought from America. The decoction of cochineal is a very beautiful crimson colour. Alum brightens the colour of the decoction, and occasions a crimson precipitate. Muriate of tin gives a copious fine rad precipitate.

Archil is a paste formed of a species of lichen pounded, and kept moist for some time with stale urine.

Madder is the root of a well known plant, (rubia tinctorium.

Carthamus is the flower of a plant cultivated in Spain and the Levant. It contains two colouring matters: a yellow,

which is soluble in water, and a red, insoluble in water, but soluble in alkaline carbonates. The red colouring matter of carthamus, extracted by carbonate of soda, and precipitated by lemon juice, constitutes the *rouge* employed by ladies as a paint. It is afterwards ground with a certain quantity of talc. The fineness of the talc, and the proportion of it mixed with the carthamus, occasion the difference between the cheaper and dearer kinds of rouge.

Brazil wood is the wood of a tree growing in America and the West Indies. Its decoction is a fine red colour.

None of the red colouring matters has so strong an affinity for cloth as to produce a permanent red, without the assistance of mordants. The mordants employed are alumine, and oxyde of tin; oil, and tan, in certain processes, are also used; and tartar, and muriate of soda, are frequently called in as auxiliaries.

Lac is the production of an insect brought from India. The decoction of it, in water, gives a deep crimson colour.

Logwood, called also Campeachy wood, is the wood that grows in Jamaica and the bay of Campeachy. It gives out its colouring matter, which is of a fine red, copiously to alkohol, and more sparingly to water.

Wool may be dyed red with madder or archil, but these are used only for coarse woollen stuffs. The stuffs are first boiled for some hours in alum and tartar, and then wrung out. After remaining some days, they are boiled in a decoction of madder.

Scarlet is the most splendid of all reds, but is of different shades, like other colours. Alumine was formerly used as a mordant for fixing the cochineal which is used for dyeing red, but nitro muriate of tin is now employed for this purpose, as it gives a brighter colour to the cochineal. To dye woollen cloth scarlet, it is first boiled in a bath of pure tartar, to which a little cochineal has been added, and also nitro muriate of tin. After this it is well washed, and then subjected to a second bath of cochineal, which is called the reddening. Sometimes they do not change the bath, but add the reddening to the first bath.

As the red produced by cochineal alone is rather a crimson than a bright scarlet, to produce the latter it is necessary first to dye the cloth yellow, and after crimson, as bright scarlet is a compound of crimson and yellow. This is done by the use of fustic, turmeric, or quercitron bark, in the first bath; to produce the yellow, the second bath is cochineal alone, which naturally gives a crimson tinge.

When crimson is the colour required to be dyed, the tin mordant is the best, but sometimes dyers use alum baths for this purpose, and then a decoction of cochineal. The addi-

tion of archil and potash to the cochineal renders the crimson darker, and gives it more bloom, but this is very fugacious. For paler crimsons, a portion of madder is substituted for part of the cochineal.

Silk is usually dyed red with cochineal or carthamus, and sometimes with Brazil-wood. Kermes does not answer for silk; madder is scarcely ever used for that purpose, because it does not yield a colour bright enough. Archil is employed to give silk a bloom; but it is scarcely used by itself, unless when the colour wanted is lilac.

Silk may be dyed crimson by steeping it in a solution of alum, and then dyeing it in the u ual way in a cochineal bath.

The colours known by the names of poppy, cherry, rose, and flesh colour, are given to silk by means of carthamus. The process consists merely in keeping the silk, as long as it extracts any colour, in an alkaline solution of carthamus, into which as much lemon juice as gives it a fine cherry colour, has been poured.

Silk cannot be dyed a full scarlet; but a colour approaching to scarlet may be given it, by first impregnating the stuff with murio sulphate of tin, and afterwards dyeing it in a bath, composed of four parts of cochineal, and four parts of quercitron bark. To give the colour more body, both the mordant and the dye may be repeated. A colour approaching scarlet may be also given to silk, by first dyeing it crimson, then dying it with carthamus, and lastly, yellow without heat.

Cotton and *linen* are dyed red with madder. The process was borrowed from the East. Hence, the colour is often called Adrianople, or Turkey red. The cloth is first impregnated with oil, then with galls, and lastly, with alum. It is then boiled for an hour in a decoction of madder, which is commonly mixed with a quantity of blood. After the cloth is dyed, it is plunged into a soda lye, in order to brighten the colour. The red given by this process, is very permanent, and when properly conducted, it is exceedingly beautiful. The whole difficulty consists in the application of the mordant, which is by far the most complicated employed in the whole art of dyeing.

Cotton may be dyed scarlet by means of murio sulphate of tin, cochineal, and quercitron bark, used as for silk, but the colour is too fading to be of any value.

471. *Of Dyeing Black.*

The substances employed to give a black colour to cloth are, red oxyde of iron, and tan. These two substances have a strong affinity for each other; and when combined, assume

a deep black colour, not liable to be destroyed by the action of air or light.

Logwood is usually employed as an auxiliary, because it communicates lustre, and adds considerably to the fulness of the black. Logwood yields its colouring matter to water. The decoction is at first a fine red, bordering on violet; but if left to itself, it gradually assumes a black colour. Acids give it a deep red colour; alkalis a deep violet, inclining to brown; sulphate of iron renders it as black as ink, and occasions a precipitate of the same colour.

Cloth, before it receives a black colour, is usually dyed blue: this renders the colour much fuller and finer than it would otherwise be. If the cloth be coarse, the blue dye may be too expensive; in that case a brown colour is given, by means of walnut peels.

Wool is dyed black by the following process:—It is boiled for two hours in a decoction of nut-galls; and afterwards kept for two hours more in a bath composed of logwood and sulphate of iron, at a scalding heat, but not boiled. During the operation, it must be frequently exposed to the air; because the green oxyde of iron, of which the sulphate is composed, must be converted into red oxyde, by absorbing oxygen, before the cloth can acquire a proper colour. The common proportions are five parts of galls, five of sulphate of iron, and thirty of logwood, for every hundred of cloth. A little acetite of copper is commonly added to the sulphate of iron; because it is thought to improve the colour.

Silk is dyed nearly in the same manner. It is capable of combining with a great deal of tan; the quantity given is varied at the pleasure of the artist, by allowing the silk to remain a longer or shorter time in the decoction.

Linen and cotton are not easy to dye of a full black. The cloth, previously dyed blue, is steeped for 24 hours in a decoction of nut-galls. A bath is prepared, containing acetite of iron, formed by saturating acetous acid with brown oxyde of iron: into this bath the cloth is put in small quantities at a time, wrought with the hand for a quarter of an hour, then wrung out, and aired again; next wrought in a fresh quantity of the bath, and afterwards aired. These alternate processes are repeated, till the colour wanted is given. A decoction of alder-bark is usually mixed with the liquor containing the nut-galls.

472. *Of Dyeing Brown.*

Brown, or fawn colour, though in fact a compound, is usually ranked among the simple colours, because it is applied to cloth by a single process. Various substances are used for brown dyes.

Walnut peels, or the green covering of the walnut; when first separated, they are white internally, but soon assume a brown, or even a black colour, on exposure to the air. They readily yield their colouring matter to water. They are usually kept in large casks, covered with water, for above a year before they are used. To dye wool brown with them, nothing more is necessary, than to steep the cloth in a decoction of them, till it has acquired the wished for colour. The depth of the shade is proportional to the strength of the decoction. The root of the walnut tree contains the same colouring matter, but in a smaller quantity. The bark of the burch also, and many other trees, may be used for the same purpose. It is very probable that the brown colouring matter is in these vegetable substances combined with tan. This is certainly the case in sumach, which is often employed to produce a brown. This combination explains the reason why no mordant is necessary; the tan has a strong affinity for cloth, and the colouring matter for the tan. The dye stuff and the mordant, are already, in fact, combined together.

473. *Of Dyeing Compound Colours.*

Compound colours are produced by mixing together two simple ones; or, which is the same thing, by dyeing cloth first one simple colour, and then another. These colours vary to infinity, according to the proportions of the ingredients employed. They may be arranged under the following classes:—

Mixtures.—1. Blue and yellow; 2. Blue and red; 3. Yellow and red; 4. Black and other colours.

Mixtures of blue and yellow. This forms *green*, which is distinguished by dyers into a variety of shades, according to the depth of the shade, or the prevalence of either of the component parts. Thus we have *sea-green*, *grass-green*, *pea-green*, &c

Wool, silk, and linen, are usually dyed green, by giving them first a blue colour, and afterwards dyeing them yellow; because, when the yellow is first given, several inconveniences follow: the yellow partly separates again in the blue vat, and communicates a green colour to it, and thus renders it useless for every other purpose, except dyeing green. Any of the usual processes for dyeing blue and yellow may be followed, taking care to proportion the depth of the shades to that of the green required. When sulphate of indigo is employed, it is usual to mix all the ingredients together, and to dye the cloth at once; this produces what is known by the name of *Saxon*, or *English green*.

Mixtures of blue and red. These form different shades of

violet, *purple*, and *lilac*. Wool is generally first dyed blue, and afterwards scarlet, in the usual manner. By means of cochineal mixed with sulphate of indigo, the process may be performed at once. Silk is first dyed crimson by means of cochineal, and then dipped into the indigo vat. Cotton and linen are first dyed blue, then galled, and soaked in a decoction of log-wood; but a more permanent colour is given by means of oxyde of iron.

Mixtures of yellow and red. This produces *orange*. When blue is combined with red and yellow on cloth, the resulting colour is *olive*. Wool may be dyed orange, by first dyeing it scarlet, and then yellow. When it is dyed first with madder, the result is *cinnamon colour*.

Silk is dyed orange by means of carthamus; a cinnamon colour by logwood, Brazil-wood, and fustic mixed together.

Cotton and linen receive a cinnamon colour by means of weld and madder; and an olive colour, by being passed through a blue, yellow, and then a madder bath.

Mixtures of black with other colours. These constitute *greys*, *drabs*, and *browns*. If cloth be previously combined with brown oxyde of iron, and afterwards dyed yellow with quercitron bark, the result will be a *drab* of different shades, according to the proportion of mordant employed. When the proportion is small, the colour inclines to olive or yellow; on the contrary, the drab may be deepened or saddened, as the dyers term it, by mixing a little sumach with the bark.

474. *CURRYING.*

The art of currying consists in rendering tanned skins supple and of uniform density, and impregnating them with oil, so as to render them in a great degree impervious to water.

The stronger and thicker hides are usually employed for making the soles of boots and shoes, and these are rendered fit for their several purposes by the shoe makers after they are tanned; but such skins as are intended for the upper leathers and quarters of shoes, for the legs of boots, for coach and harness leather, saddles, and other things, must be subjected to the process of currying.

These skins after coming from the tanners, having many fleshy fibres on them, are well soaked in common water. They are then taken out and stretched upon a very even wooden horse; where with a paring knife all the superfluous flesh is scraped off, and they are again put into soak. After the *soaking* is completed, the currier takes them again out of the water, and having stretched them out, presses them with his feet, or a flat stone fixed in a handle, to make them more supple, and to press out all the filth that the leather may

have acquired in tanning, and also the water it has absorbed in soaking.

The skins are next to be *oiled*, to render them pliant and impervious to wet. After they are half dried, they are laid upon tables, and first the grain side of the leather is rubbed over with a mixture of fish oil and tallow; then the flesh side is impregnated with a large proportion of oil. After having been hung up a sufficient time to dry, they are taken down and rubbed, pressed, and folded in various directions, and then spread out, when they are rolled with considerable pressure upon both sides with a fluted board fastened to the operator's hand by a strap; by this means, and by repeating the rolling, a grain is given to the leather.

After the skins are curried, it may be required to colour them. The colours usually given to them are black, white, red, green, yellow, &c.

If the skins are to be blacked, the process varies according to the side of the skin to be coloured. Leather that is to be blacked on the flesh side, which is the case with most of the finer leather intended for shoes and boots, is coloured with a mixture of lamp black, oil, and tallow rubbed into the leather. And what is to be coloured on the grain side is done over with chamber lye, and then with a solution of sulphate of iron, which turns it black.

475. *MANUFACTURE OF SODA.*

Soda, or the mineral alkali, is sometimes found in a native state, as in the lakes of Natron in Egypt, which are dry in the summer season; the water leaving after evaporation a bed of soda, or, as it is there called, *natron*, of two feet in thickness.

A marine plant, called the *Salsola soda*, which grows among the cliffs on the sea coast, seems to be endowed by nature with the property of decomposing the salt water, that is, of separating the muriatic acid from the soda, which latter it absorbs. This plant is collected by the Spaniards with great care, and burnt for the manufacture of *barilla*, which is a carbonate of soda mixed with various impurities.

Soda is also procured in a still more impure state, by the burning of the sea weeds on our own shores, particularly in Scotland, from which is produced a substance called *kelp*.

But the demand for a pure carbonate of soda having become very considerable of late years, from its great utility in many arts and processes, various means have been tried for procuring it by decomposing the salts, in which it exists, combined with acids. Muriate of soda has been decomposed for this purpose, but this process has been found too expensive. The following method is described by Mr. Accum, in Nicholson's Journal.

Solutions of 500lbs. of sulphate of soda,* and 560lbs. of American potash, are made to boil, and are then mixed. As soon as the mixture boils, it is conveyed into a cistern of wood lined with lead half an inch thick, which is fixed in a cool place. Sticks of wood are then placed across the cistern, from which slips of sheet lead, two or three inches wide, are hung into the fluid, at four inches distance from each other. When all is cool, the fluid is let off, and the chrystallized salt is detached from the slips of lead, and the bottom of the trough. The salt is then washed, to free it from impurities, after which it is transferred again into the boiler, dissolved in clear water, and evaporated by heat. As soon as a strong pellicle is formed, it is suffered to cool so far that the hand may be dipped into it without injury, and the heat is kept at that temperature as long as effectual pellicles continue to be formed over the whole surface of the boiler, and then fall to the bottom. When no more are formed, the fire is withdrawn, and the fluid ladled out into the cistern to chrystallize. The sulphate of potash, &c. which had been deposited, is then taken out of the boiler, and put aside. By this process from 136 to 139lbs. of soda may be obtained from 100lbs. of sulphate of soda.

476. *MANUFACTURE OF POTASH.*

Potash, or the fixed vegetable alkali, exists as an ingredient, in very small quantity, in many minerals. It is also obtained from the tartar, or from lees of wine, in which it is called *salt of tartar*.

But the great supply of this substance is procured from the ashes of burnt vegetables.

In many districts of England and Ireland, they burn the common fern to ashes, which they mould up with a little water into balls of about three or four inches in diameter; these are called *ash balls*, and are the rudest preparation of this alkali.

The potash of commerce, or *black potash*, is always procured from the combustion of wood, and can therefore only be made in those countries where wood is very plentiful, as Poland, Russia, and Germany. This country is chiefly supplied from America. The ashes of burnt wood are put into a cistern with water, and a strong lixivium is made. After a time the water, holding the alkali in solution, is drawn off, leaving the impurities behind.

Potash is converted into a purer state by calcining it in a reverberatory furnace. It becomes then dry, porous, con-

* Sulphate of soda is sold cheap by the bleachers, who save it as the residue of decomposing common salt by sulphuric acid with manganese.

siderably caustic, extremely deliquescent, and of a beautiful bluish colour, from which it is called *pearl ash.*

All these are carbonates of potash.

To obtain potash in a state of perfect purity, or uncombined with carbonic acid, the carbonate must be boiled with twice its weight of quick-lime, to deprive it of the carbonic acid; then to free it from other impurities, it must be dissolved in spirits of wine, (which dissolves alkalis and no other salt) and the solution evaporated to dryness. It is then pure and powerfully caustic.

477. *Method of taking a Cast in plaster from a person's face.*

The person whose likeness is required in plaster, must lie on his back, and the hair must be tied back, so that none of it covers the face. Into each nostril convey a conical piece of stiff paper open at both ends, to allow of breathing. The face is then lightly oiled over in every part with salad-oil, to prevent the plaster from sticking to the skin. Procure some fresh burnt plaster, and mix it with water to a proper consistence, for pouring. Then pour it by spoonfuls quickly all over the face, (taking care the eyes are shut) till it is entirely covered to the thickness of a quarter of an inch. This substance will grow sensibly hot, and in a few minutes will be hard. This being taken off, will form a mould, in which a head of clay may be moulded, and therein the eyes may be opened, and such other additions and corrections may be made as are necessary. Then, this second face being anointed with oil, a second mould of plaster must be made upon it, consisting of two parts joined lengthwise along the ridge of the nose; and in this a cast in plaster may be taken, which will be exactly like the original.

478. *To take Casts of Medals.*

In order to take copies of medals, a mould must first be made; this is generally either of plaster of Paris, or of melted sulphur.

After having oiled the surface of the medal with a little cotton, or a camel's-hair pencil dipped in oil of olives, put a hoop of paper round it, standing up above the surface of the thickness you wish the mould to be. Then take some plaster of Paris, mix it with water to the consistence of cream, and with a brush rub it over the surface of the medal, to prevent air holes from appearing; then immediately afterwards make it to a sufficient thickness, by pouring on more plaster. Let it stand about half an hour, and it will in that

time grow so hard, that you may safely take it off; then pare it smooth on the back and round the edges neatly. It should be dried, if in cold or damp weather, before a brisk fire. If you cover the face of the mould with fine plaster, a coarser sort will do for the back: but no more plaster should be mixed up at one time then can be used, as it will soon get hard, and cannot be softened without burning over again.

Sulphur must not be poured upon silver medals, as this will tarnish them.

To prepare this mould for casting sulphur or plaster of Paris in, take half a pint of boiled linseed-oil, and oil of turpentine one ounce, and mix them together in a bottle; when wanted, pour the mixture into a plate or saucer, and dip the surface of the mould into it; take the mould out again, and when it has sucked in the oil, dip it again. Repeat this till the oil begins to stagnate upon it; then take a little cotton wool, hard rolled up, to prevent the oil from sticking to it, and wipe it carefully off. Lay it in a dry place for a day or two, (if longer the better) and the mould will acquire a very hard surface from the effect of the oil.

To cast plaster of Paris in this mould, proceed with it in the same manner as above directed for obtaining the mould itself, first oiling the mould with olive-oil. If sulphur casts are required, it must be melted in an iron ladle.

THE END.